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SANTA CLARA VALLEY WATER DISTRICT

LOWER COYOTE CREEK FLOOD CONTROL PROJECT
REACHES 1 THROUGH 3
REPORT OF MITIGATION AND MONITORING PROGRAMS
1996 TO 1998

(DIXON LANDING ROAD TO MONTAGUE EXPRESSWAY
CITIES OF SAN JOSE AND MILPITAS, CALIFORNIA)

PROJECT NO. 402111

S-12

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EXECUTIVE SUMMARY

The Lower Coyote Creek flood control project was constructed in the cities of San Jose and Milpitas by the Santa Clara Valley Water District (District) and other agencies along a 7-mile stretch of Coyote Creek between San Francisco Bay near Dixon Landing Road and Montague Expressway between 1985 and 1996. The project includes three main types of mitigation: a Salt Marsh Harvest Mouse (SMHM) management area, riparian revegetation, and fisheries measures. Most of the mitigation features have been installed and are now under long-term maintenance and monitoring. This report summarizes the condition of these mitigation features as determined by a monitoring program and, where appropriate, makes recommendations for changes.

SALT MARSH HARVEST MOUSE MANAGEMENT AREA AND WATERBIRD POND

During design of the flood control project, a small population of SMHM was discovered in a diked marsh near the bay end of the project. SMHM is listed as endangered under both the federal and California endangered species acts. The project was subsequently redesigned, and planting of additional SMHM habitat was included.

Few to no SMHM were found during biennial surveys after installation of the SMHM habitat, with five SMHM found in 1997. The amount of pickleweed-dominated vegetation in the SMHM management area has fluctuated between 7 to 12 acres and was 9 acres in 1997.

Several retrofits have been made to the water control structures associated with the diked marsh. The District will conduct experiments to determine how to best operate the recently-retrofitted slide gate/culvert configuration.

A 16.5-acre pond was created as a shallow brackish water habitat for waterfowl and shorebirds. The waterbird pond is used extensively by a large number of bird species as wintering habitat, as a stopover point during migration, and American Avocets and Black-Necked Stilts nest on the island. The District expects to remove sediment from the waterbird pond in the next few years.

RIPARIAN REVEGETATION AND RIPARIAN WILDLIFE

The flood control project resulted in the removal of approximately 13 acres of riparian forest. Several types of streamside habitats have subsequently been planted as mitigation: 28 acres of riparian forest, 3 acres of setback (buffer) areas, 2 acres planted for shade directly along the creek, and approximately 1 acre of low plants on crossover areas.

In 1998, the pilot revegetation site was 12 years old and had an absolute cover of overstory vegetation of 58 percent. In 1996, Riparian Site 6-1, another revegetation site which was in its third year, had an absolute cover of overstory vegetation of 23 percent. Over 80 percent of the plants installed 2 years ago in the riparian forest sites in Reach 3 have survived. All riparian forest revegetation sites show an increasing trend of cover of both understory and overstory vegetation. Setback, shade, and crossover sites are similarly filling in with vegetation.

The riparian revegetation sites have been found to provide good habitat for winter resident birds, and large numbers of migratory birds stop at these areas to feed. The small mammal, reptile, and amphibian communities are relatively small and undeveloped.

Several Reach 3 riparian revegetation sites were partially damaged by floods or construction of the Tasman extension. These will be reexamined to determine if replanting is necessary. The District is recommending a consolidated vegetation and wildlife monitoring schedule at all the Lower Coyote Creek revegetation sites with the next major monitoring occurring in the year 2001.

FISHERIES MITIGATION AND STANDISH DAM

The project included the installation of in-stream structures to facilitate fish passage or create fish habitat, the placement of spawning gravels, and planting of areas to shade the creek. The in-stream structures are regularly inspected and appear to be operating. Spawning gravels were placed in 1995, 1996, and 1999; however, spawning was observed only once at this location. A new technique for placement of spawning gravels without disturbing the creek bank was tested in 1999. Survival and growth of vegetation planted at the aquatic shade sites has generally been good. The shade monitoring model has produced irregular and unreliable results; therefore, the District recommends it no longer be used.

Standish Dam is a seasonal structure, which has been placed across Lower Coyote Creek during the summer for decades. A modified version of the dam was originally proposed as a fisheries mitigation feature for the project. Recently, there have been concerns that Standish Dam may be detrimental to anadromous fish, and the dam is not being installed for an experimental 3-year period to determine possible long-term effects. A preliminary estimate is that as much as 6 to 10 acres of riparian habitat might convert to brackish marsh if the dam was no longer operated. This estimate is based primarily on groundwater monitoring. In 1998, the second year of the experimental period, no conversion of riparian habitat was noted.

INTRODUCTION

PURPOSE OF REPORT

This report updates the status of the mitigation and monitoring program for the Lower Coyote Creek flood control project. Reference to the information contained herein should assist in determining if the mitigation projects are functioning and developing as planned, and help determine if changes to the mitigation design or monitoring program need to be made.

The Lower Coyote Creek flood control project was constructed by the District and associated agencies between 1985 and 1996 in Santa Clara County, California, from Dixon Landing Road to Montague Expressway (Figure 1). All figures, tables, and attachments are included at the end of the report. The project includes a wide range of mitigation measures to compensate for environmental impacts to wetland, riparian forest, wildlife, and fishery values of Coyote Creek. Installation of the mitigation features began in 1987 and continued through 1996. Monitoring and operation of the mitigation features will continue at some level over the life of the project (100 years).

The District received four U.S. Army Corps of Engineers (Corps) permits for construction of the Lower Coyote Creek flood control. Additional approvals were received from the California Regional Water Quality Control Board, San Francisco Bay Conservation and Development Commission, and California Department of Fish and Game (CDFG). One Environmental Impact Report (EIR) and several Environmental Impact Studies (EIS) were prepared for this project (District, 1984; Corps, 1987; and Corps, 1998).

LAYOUT OF REPORT

Sections 1 through 5 describe the status of the four main types of mitigation measures and their associated monitoring programs: SMHM management area and waterbird pond, riparian revegetation, wildlife, fisheries, and Standish Dam. Each section provides a brief description of the mitigation feature and any recent modifications, a description of the monitoring program, a summary of the most recent monitoring results, and any recommended change to either the monitoring program or the mitigation design. Reference is made to detailed reports.

LOCATION OF PROJECT

The Lower Coyote Creek flood control project is located in the cities of San Jose and Milpitas near the southern end of San Francisco Bay. The project extends from a location near Dixon Landing Road upstream approximately 7 miles to Montague Expressway (Figure 1). The flood control project is divided into three reaches. Reach 1 begins at the confluence of Coyote Creek and South Coyote Slough near the margin of San Francisco Bay, and extends approximately 2.5 miles upstream to the former location of the Milpitas Sewage Treatment Plant (Figures 2 and 3). Reach 1 was constructed in two phases in 1988 and 1989. The western portion of Reach 1 is a tidal channel with either open water (former salt pond) or stands of alkali bulrush. An earthen levee with flapgated culverts has historically separated a pickleweed marsh on the eastern portion of Reach 1 from the daily fluctuations of the tides.

temporarily close the site off from tides. The internal culverts were removed by November of 1997.

In February of 1998, the slide gate was opened to allow tidal flushing of the marsh; however, sometime later in the month the outside dike breached again. The breach was repaired in April 1998. At the same time, one 54-inch flapgate was replaced with a slide gate. This was a modification to the original plan to replace both 48-inch flapgates with slide gates because a consulting hydrologist concluded from his analysis of the site hydrology that the 54-inch slide gate structure would provide adequate water to the site. Through late June and early July of 1998, hydrologic observations were made of the site while the slide gate aperture was opened from approximately 10 percent to 100 percent during a spring tide period. In early July 1998, the slide gate was closed again. Experimental operation of the slide gates and hydrologic observations will continue in the summer of 1999 to determine the optimal configuration of the water control structures to meet site goals.

1.1.2 Monitoring Program

The 1987 Wetland Habitat Management Plan (Harvey et al., 1987) presented the following recommendations for monitoring the SMHM management area. Soil attributes (moisture, pH, soil salinity, and nitrate) and pickleweed growth and health are to be sampled twice per year in 20 permanent square meter plots. Soil is to be sampled in the wet and in the dry season until the system stabilizes. A general description of the plant growth is to be prepared along with photodocumentation. SMHM are to be trapped in alternate years during the summer with three sets of 150 traps placed in each major habitat type for 4 consecutive nights. The monitoring data is to be submitted annually to CDFG and the U.S. Fish and Wildlife Service (USFWS). This plan did not establish any success criteria for the SMHM management area.

Over the years, the Water District has modified the monitoring program of the SMHM management area. This program monitors vegetation every 1 to 2 years focusing on potential SMHM habitat (pickleweed-dominated habitat), analyzes soil conditions biannually to indicate conditions which might influence pickleweed establishment and growth, and traps for SMHM on a biennial basis.

1.1.2.a Vegetation

Vegetation monitoring began in 1989. Through 1991, monitoring consisted of periodic visual observation and photodocumentation of the planted marsh and levee slopes to determine the success of the revegetation effort. In 1992, biennial sampling began with a specific focus on quantifying the extent of pickleweed-dominated vegetation and qualitatively characterizing it as good, poor/marginal, or nonhabitat for SMHM. From 1993 through 1995 and in 1997, the sampling program was expanded to include mapping of the major vegetation associations throughout the site using aerial photographs (1-inch to 100-foot scale) and field truthing (Duke et al., 1997).

1.1.2.b Soils

Soils were sampled in 1985, October 1993, May 1994, October 1995, June and October 1997, and June and September 1998. Since 1993, the sampling has occurred at approximately the same ten locations. Soil samples were generally analyzed for texture, pH, electrical conductivity, sodium, calcium, magnesium, and chloride. In some years, exchangeable sodium percentage and sodium absorption rate were calculated.

1.1.2.c Salt Marsh Harvest Mouse

The original survey for SMHM occurred in 1985, with postconstruction surveys occurring in 1990, 1993, 1995, and 1997. Except in 1997, trapping grids were established in the same locations each year in the preexisting marsh, the planted marsh, and south of the waterbird pond. Two trap grids were not set in the preexisting marsh in 1997 due to the presence of standing water at these locations throughout much of the winter. Two new areas were surveyed in 1997: one was near a former sampling location and the other was along the perimeter of the waterbird pond where a robust stand of pickleweed has established (Duke et al., 1998).

1.1.3 Monitoring Results

1.1.3.a Vegetation

The presence of pickleweed-dominated vegetation and its quality as SMHM habitat varied throughout the 1989 to 1997 monitoring period. Table 2 summarizes the changes in pickleweed habitat since 1992. The total area of pickleweed-dominated vegetation increased 4.7 acres from 1992 to 1994, primarily due to an increase in the planted marsh. Although pickleweed-dominated vegetation continued to increase in the planted marsh, in 1995, pickleweed in the preexisting marsh decreased. Higher rainfall years appear to have decreased the salinity levels and increased the moisture levels of soils in the planted marsh, resulting in an expansion of 0.7 acres of pickleweed in this formerly barren, hypersaline area. However, the increased rainfall apparently resulted in the 2.1-acre decrease of pickleweed abundance in the preexisting marsh.

Between 1995 and 1997, the preexisting marsh increased its total area of pickleweed-dominated vegetation by 0.6 acres, primarily as a result of growth in the center of the site (eastern side of the preexisting marsh). The preexisting marsh also lost some pickleweed-dominated areas including an area near the dike which had formerly been occupied by SMHM. The pickleweed-dominated areas decreased by 1.9 acres in the planted marsh. These shifts in vegetation were different than predicted for the muted tidal condition, and most of the change can be attributed to the breaching of the outside dike which allowed tidal inundation of vegetation.

Location and abundance of pickleweed in the diked Coyote marsh appear to be dependent on the amount of annual rainfall and sporadic events such as removal of historic structures, adjustments of water control structures, and breaching of the outside dike. To date, the preexisting marsh and planted marsh have often responded differently to year-to-year changes in rainfall and tidal inundation. As of 1997, large areas of the site remain unvegetated.

1.1.3.b Soils

As expected, electrical conductivity of soil samples was generally greater in the fall sampling periods than in spring sampling periods. This is probably due to the influence of winter precipitation and flooding on the spring samples. In 1998, soil salinity was highest in areas dominated by pickleweed and bare ground, and lowest in areas dominated by annual grasses, perennial peppergrass, and alkali heath. The mean soil salinity generally decreased from 1996 through 1998 at all sampling locations. The trend in decreasing soil salinity is most likely due to the above average rainfall and the introduction of muted-tide action in 1996 (Duke et al., 1999).

1.1.3.c Salt Marsh Harvest Mouse

Clearly identifiable SMHM were found in small numbers in all monitoring years, except for 1993 when none were found (Table 4). All SMHM in all the monitoring years were found in the preexisting marsh. In 1997, no SMHM were found in a subarea of the preexisting marsh east of the outside dike that had been consistently occupied by SMHM in previous years. As described above, pickleweed cover was lost in this area due to tidal inundation when the outside dike was breached. However, SMHM were captured in 1997 in another subarea of the preexisting marsh which has been consistently surveyed but where no SMHM were previously trapped. SMHM were also found in 1997 in another subarea of the preexisting marsh which had not previously been trapped but which has developed suitable pickleweed-dominated habitat (Duke et al., 1998).

1.2 WATERBIRD POND

The waterbird pond was created as a shallow brackish water habitat for waterfowl and shorebirds during the original construction of the flood control project in 1989. It includes an island on which shorebirds nest. Much of the information presented in this subsection is from a 1998 monitoring report from the Coyote Creek Riparian Station (CCRS) (Otahal and Jaramillo, 1998).

1.2.1 Mitigation Design and Maintenance

A 16.5-acre brackish water pond was created for waterfowl habitat to replace 16.5 acres of salt evaporation ponds that were converted during construction of the flood control bypass channel. The waterbird pond is located in a former meander of the creek channel, which was straightened during construction of the flood control project.

Water level and salinity are measured on a bimonthly basis to determine when adjustments to water control structures should be made to provide suitable conditions for shorebird and waterfowl feeding in the pond (presence of muddy shoals), and to avoid flooding of shorebird nesting on the island. Pond levels need to be adjusted frequently, as water is lost through evaporation and seepage, or gained through rainfall and flooding. Adjustments are made at an inlet culvert on the main stem of Coyote Creek to the east of the waterbird pond or at an outlet culvert on the west side of the pond which drains to a channel in the SMHM management area. High tides need to be present in the creek to capture higher salinity water with the inlet culvert, while low water conditions need to be present in the SMHM management area to drain the waterbird pond.

Based on 4 years of field observations, CCRS determined that the optimal water level in the pond is 2.7 feet NGVD. However, 1997 storms deposited approximately 0.5 feet of sediment in the pond, and now the pond's water level needs to be maintained at 2.8 feet to support the important habitat features of the pond. As a result, a higher tide level is necessary to bring water into the pond. In the summer when evaporation rates are high, the sediment levels are resulting in shallower water or exposed shoals. In May of 1997, shallow conditions in the pond persisted for 2 to 3 weeks before tide levels were high enough to bring more water into the pond. In that period, only 20 percent of the pond was covered by water in four discontinuous puddles, and a land bridge formed between the pond's exterior shoreline and the island. Shorebird numbers using the pond and the success of nesting on the island did not seem to be affected by this condition in 1997.

Salinity is increased in the pond by diverting brackish water from Coyote Creek during very high tides, and then through the evaporation of pond water over a period of time. There has been an assumption that salinity levels should be maintained as high as possible in the pond to control potential avian diseases; however, the relationship between environmental conditions and outbreaks of avian diseases (avian cholera, botulism, etc.) are not currently known.

It has been difficult in some years to maintain a high salinity in the waterbird pond. The only year in which salinity was maintained at 12 parts per thousand (ppt) or higher was 1993/94. In 1996/97, salinity was never above 4 ppt; however, there were no outbreaks of avian disease. The salinity of water in Coyote Creek at the inlet point has been measured at various times and ranges between 0 and 26 ppt (Stanley et al., 1991; Stanley et al., 1992; Leone, 1996; and Salsbery, 1999).

1.2.2 Monitoring Program

There are no formal requirements for monitoring of the waterbird pond; however, a monitoring program has been implemented to track bird use and to manage the pond level and salinity. Bird use of the pond was surveyed one morning each week throughout the year, unless bad weather or flooding prevented access to the site. All individual birds on the pond or island were counted and identified to species.

1.2.3 Monitoring Results

The waterbird pond is used extensively by a large number of individual birds and bird species as wintering habitat, migratory stopover habitat, and breeding habitat. From year to year, the number of birds, species, and seasonal patterns have varied somewhat, but some patterns have been established (Table 5). In general, shorebirds are the dominant group using the pond, and American Avocets and Black-Necked Stilts use the island for nesting. Waterfowl numbers peak in winter months with the most abundant waterfowl species being the Northern Shoveler. Gulls are also common on the waterbird pond.

1.3 PROPOSED MANAGEMENT MEASURES FOR SALT MARSH HARVEST MOUSE MANAGEMENT AREA AND WATERBIRD POND

- The District will design a plan and conduct trial and error experiments to determine appropriate operation of the retrofitted slide gate/culvert configuration of the SMHM management area.

- In the future, it will be necessary to remove sediment from the waterbird pond. This was anticipated in the original management plan (Harvey et al., 1987). Sediment removal should be designed and scheduled to minimize impact to birds and water quality. To avoid impacts to bird species using the pond, it would be best to avoid removing sediment during the breeding season (mid-February to mid-August) and fall and spring migratory season. Bird use is lowest during the early winter months (mid-November through mid-February); however, the potential for flood events during this period make it infeasible to operate equipment in the pond at that time. CCRS has recommended the fall period (mid-August to mid-November) as the second best time to minimize disturbance to breeding activities. Birds quickly colonized after the original construction of the pond, and we expect no long-term adverse effects to bird use of the pond from occasional sediment removal activities. The District expects to conduct this work in the year 2000.

- The District anticipates meeting with the agency staff at the waterbird pond in 2000 to determine if the original wildlife goals have been met and if bird monitoring can cease at this location.

- The District will regularly inspect and repair, as needed, the outside dike to the SMHM management area.

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SECTION 2. RIPARIAN REVEGETATION

There are several distinct types of riparian revegetation plantings in the Lower Coyote Creek flood control project: riparian forest, crossover areas, setback areas, and shade plantings. See Table 6 for a summary of the various riparian revegetation sites and Figures 3, 4, and 5.

The purpose, design, and monitoring requirements vary for each of these different mitigation types. Furthermore, monitoring requirements were very general when the project was first reviewed and approved (1980s), but became more specific as later stages of the project were implemented a decade later. As a result, the mitigation and monitoring requirements for early phases of riparian revegetation are not always the same as for later, usually more upstream, stages. The District attempts to manage and monitor these sites in a similar manner whenever possible.

Because the purpose of shade plantings is to improve fish habitat, they are discussed under Section 4. Recent changes to the operation of Standish Dam are expected to affect the purpose and condition of the riparian corridor on the lower end of the creek and are discussed under Section 5.

2.1 RIPARIAN FOREST

2.1.1 Mitigation Design and Maintenance

To compensate for the loss of riparian forest as a result of constructing the Lower Coyote Creek flood control project, a mitigation program to revegetate 28.7 acres of riparian forest in Reaches 2 and 3 has been established. As different phases of the project were implemented and redesigned over a 7-year period, the amount of acres required for riparian forest mitigation has changed. See Table 7 for a summary of the required mitigation acreage. To date, 12.2 acres of riparian forest have been planted in Reach 2. Since the last monitoring report, the Corps—Sacramento planted the remaining 16.5 acres in Reach 3 in 1996 and early 1997.

Goals of the riparian forest revegetation program are to replace riparian vegetation removed by construction, widen the riparian corridor, create riparian habitat that will support diverse plant and wildlife species, and promote the development of a multilayered canopy and dense understory. The design consists of planting riparian trees (primarily Fremont cottonwood, willows, box elder, and blue elderberry), with later projects including more shrubs (primarily coyote brush, mule fat, California rose, and California blackberry), and herbaceous species (primarily western goldenrod, marsh baccharis, and beardless wildrye.)

2.1.2 Monitoring Program

Throughout this report when reference is made to monitoring years, Year 0 means from the date plant installation is completed until the beginning of the next growing season (spring/summer). Because plants are often installed in the fall, Year 0 often is approximately 7 months long (October to April). Year 1 starts at the first growing season and continues to the start of the next growing season, and likewise for subsequent years.

For the Reach 3 plantings, year 0 is considered 1996 since most of the plantings were installed in that year.

The 1988 EIS requires that vegetation and wildlife be monitored on one riparian forest site (the pilot revegetation site, also referred to as Riparian Site 5-4) on an annual basis for 10 years, and then every 5 years for the first 15 years, and once every 10 years thereafter for the life of the project (100 years). For the other riparian forest revegetation sites (Site 6-1 in Reach 2 and Sites R-1 to R-6 in Reach 3), the monitoring frequency is every 5 years for the first 15 years, and once every 10 years thereafter for the life of the project. The monitoring results will be reported for all revegetation sites in years 5, 15, and 55. Other environmental analyses and approvals for the Reach 2 project require a slightly different monitoring program; however, the program included in the 1988 EIS is the most comprehensive and, therefore, is considered the definitive requirement. No specific methods or success criteria were established for monitoring of riparian vegetation.

The Reach 3 vegetation monitoring requirements are more detailed than those required for Reach 2. A mitigation and monitoring program was prepared by the District in 1994 for a permit from the Corps—San Francisco for construction of the Reach 3 portion of the flood control project (District, 1994). Subsequently, Reach 3 became a federal project and the mitigation sites were installed and are under initial monitoring by the Corps—Sacramento. The federal project has a slightly different mitigation and monitoring program for Reach 3 than was originally proposed by the District. Both programs are described below and recommendations are made to resolve the discrepancies.

2.1.2.a U.S. Army Corps of Engineers—San Francisco District Permit

The U.S. Army Corps of Engineers—San Francisco District (Corps—San Francisco) permit (District, 1994 and Corps—San Francisco, 1994) requires annual fall vegetation monitoring of all the Reach 3 riparian forest revegetation sites during the establishment period (0 to 5 years after completion of planting or until 2001). In the initial years, the annual monitoring includes an assessment of survival, vigor, structure, browse, and regeneration (trees and shrubs). In later years, the monitoring shifts to absolute percent canopy cover. The shift from survival to cover analysis will occur when it is infeasible to monitor individual plants due to growth and intermixing of plants. From previous experience, this is estimated to occur in year 3. Representative sampling is to be conducted by means of permanent transects and analyzed on a site-by-site basis.

Subsequent to the establishment period, long-term monitoring will be conducted in Reach 3 for the life of the project (100 years) in order to establish and document a general trend towards reaching a self-sustaining system. Long-term monitoring for vegetation will begin in year 10 (2006), repeat in year 15 (2011), and then every 10th year until year 100 (2021, 2031, 2041, 2051, 2061, 2071, 2081, and 2091) and will consist of absolute percent canopy cover monitoring as described for the establishment period. In years of no scheduled monitoring, annual qualitative site assessments will be conducted. During these annual site assessments, the general site conditions will be recorded and the need for additional maintenance will be determined. If site conditions during a nondata collecting year appear to warrant investigation, an additional year of cover monitoring may be conducted. In year 8 (2004), a qualitative evaluation will be conducted to assess whether the sites are likely to meet the long-term success criteria.

Groundwater monitoring will be conducted during the establishment period. Twelve groundwater wells are monitored in the Reach 3 revegetation sites. Permanent photographic monitoring points will be established within and overlooking the project area to assist in evaluating the overall community character. Panoramic photographs will be taken twice annually in spring and fall in years when quantitative monitoring data is collected.

Annual reports on the mitigation program will be submitted to the Corps—San Francisco, USFWS, National Marine Fisheries Service (NMFS), and CDFG in December for years 1 through 5, 8, and 10 (1997, 1998, 1999, 2000, 2001, 2004, 2006). For the year 5 and year 10 reports (2001 and 2006), an evaluation will be made regarding whether the 5-year and 10-year success criteria have been met. Subsequent reports will be submitted in December of each future year in which quantitative monitoring data is collected. The monitoring reports will include information on the survival, growth, and vigor of the planted woody species or vegetative cover, condition of the herbaceous vegetation, need for replanting, natural recruitment of plants, remedial actions taken, and any other relevant information. Prints of the relevant photographs, monthly rainfall at Coyote Creek, peak creek flows, identification of the preparers of the report and site monitors, and a copy of the Corps permit with any special conditions or letters of modification will be provided.

The Corps permit has the following success criteria for Reach 3 riparian forest revegetation sites. By year 5 (2001), the revegetation sites must have an average absolute middle to upper canopy cover of 45 percent or greater. No individual riparian forest revegetation site shall have less than 50 percent survival. Year 5 success criteria will not be considered to have been met until at least 2 years after the last major human intervention such as planting or irrigation. At year 10 (2006), the average absolute middle to upper canopy cover of trees and shrubs must show a steady trend towards 70 percent or greater, and no less than 50 percent absolute middle to upper canopy cover of trees and shrubs species shall occur in any revegetation site.

2.1.2.b U.S. Army Corps of Engineers—Sacramento District, Reach 3, Monitoring Program

The Corps—Sacramento established a slightly different monitoring program for Reach 3, which has been implemented by their revegetation contractor, Sierra View Landscape, since 1996 (Corps—Sacramento, 1995 and Sierra View Landscape, Inc., 1996). Annual September monitoring of plant survivorship, vigor, and tree height, with qualitative observations regarding browse, vandalism, and poor stock are conducted. Panoramic and site photographs are taken in the spring and fall of each year. The District continues to monitor groundwater wells during this period.

For Reach 3, riparian forest revegetation sites have a required survival rate of installed plants of 85 percent, 80 percent, and 75 percent in the first, second, and third years, respectively. Because of the substantial growth of plants in these revegetation sites by 1999, and the inability to identify individual plants, monitoring in year 3 is expected to switch to a cover technique.

2.1.2.c Recommended Reach 3 Monitoring Program

The monitoring program proposed in the 1994 Mitigation and Monitoring Program and required by the Corps—San Francisco is very similar to that currently being implemented by the Corps—Sacramento. Therefore, it is recommended that the monitoring program consist of that implemented by the Corps – Sacramento in years 0 to 3 (1996 to 1999) and that proposed in the 1994 Mitigation and Monitoring Program for all remaining years.

2.1.3 Monitoring Results

2.1.3.a Reach 2

Monitoring of cover at various revegetation sites along Lower Coyote Creek occurred in 1994, 1996, and 1998 (Tables 8, 9, and 10). This discussion will concentrate on the two riparian forest sites in Reach 2 and six riparian forest sites in Reach 3.

Survival of installed plants at Riparian Site 5-4 (pilot revegetation site) has been previously reported (Jones & Stokes Associates, 1994; District and Jones & Stokes, 1995; and District, 1996). Cover monitoring has been conducted in Reach 2 at Riparian Site 5-4 in 1994, 1996, and 1998. Riparian Site 5-4 was planted as a pilot revegetation site to experiment with different types of propagules and irrigation techniques, and to guide design of the remaining riparian revegetation sites. In years 8, 10, and 12, this site had an absolute overstory cover of 46 percent, 59 percent, and 58 percent, respectively (Table 11). The most frequent tree species are Fremont cottonwood, western sycamore, and willows.

Although not required, cover monitoring was also conducted at Riparian Site 6-1 (also referred to in some reports as Site 2) in 1996, which was year 3 for this site. Absolute overstory cover was 23 percent and absolute understory cover was 59 percent (see Table 12). Based on experience from the pilot revegetation site, a greater percentage of shrub and herbaceous species were included in the original plant palette for Riparian Site 6-1 in an attempt to create a more dense understory habitat for certain wildlife species which are noticeably lacking in the pilot revegetation site. Target herbs and shrubs represented 17 percent and 33 percent of understory absolute cover in year 3 at Riparian Site 6-1, as compared to a 3 percent and 4 percent in the pilot site in year 8. These numbers are not directly comparable because they represent different ages of each site (no representative year 3 cover data is available for the pilot site). Understory vegetation probably undergoes some shifts in the early years as the overstory cover develops and shades out some of the lower vegetation. However, the percent cover data and qualitative observations indicate that Riparian Site 6-1 is developing a dense understory with good representation of California blackberry.

Coyote brush is the most frequent of the tree or shrub species in Riparian Site 6-1, with an absolute cover of 23 percent and 4 percent in the understory and overstory layers of this site in 1996. Coyote brush readily seeded into the bare soils of the recently-planted site in year 0 from existing stands and has formed a dense thicket on a portion on the southern end of the site. Across the site, it represents 25 percent and 19 percent of relative cover in the understory and overstory layers. Volunteer coyote brush have been observed growing over and shading out other species of herbs, shrubs, and trees that were planted in the southern end of the site. In the past year, the District has undertaken selective cutting of the coyote brush in this area to encourage the growth of the other riparian plants in order to create greater diversity across this portion of the site.

Although there are no formal success criteria by which to measure the success of the Reach 2 riparian forest revegetation sites, qualitative observations indicate that the sites are progressing toward establishment of a riparian forest with a greater density and diversity of plants and a multilevel structure. The absolute cover of trees and shrubs were 66 percent and 20 percent at Riparian Site 5-4 in year 12 (1998), and 19 percent and 38 percent in year 3 (1996) in Riparian Site 6-1. A riparian forest reference site at an upstream location on Coyote Creek has absolute cover of trees and shrubs of 71 percent and 45 percent[3]. Monitoring methods and conditions at the lower and upper Coyote sites are not directly comparable; however, the riparian forest revegetation sites on Lower Coyote Creek are showing a trend of developing cover amounts similar to those at Upper Coyote Creek reference site.

2.1.3.b Reach 3

All the mitigation sites have been installed in Reach 3 by the Corps—Sacramento since the last monitoring report. Years 1 and 2 monitoring results are presented in Table 13.

Survival of all plants installed within each riparian forest site in Reach 3 ranged from 87 to 93 percent in 1998 (Table 14) which is above the 80 percent survival rate required in year 2. Over 70 percent of the plants had a vigor rating of good. The revegetation contractor has observed volunteer riparian plants and spreading of several of the target herbaceous and shrub species. The survival of each species across all the Reach 3 revegetation sites is shown in Table 15. Blue elderberry has had a higher attrition rate than other plants in the revegetation sites, and this is believed to be a result of root disease caused by extended wet soil conditions after flooding in the 2 years after planting (Sierra View Landscape, 1999).

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[3] Personal communication, Dan Stephens, H. T. Harvey and Associates to Cindy Roessler, December 15, 1993, in note regarding riparian reference site near Bernal Road on Coyote Creek for Route 85 Coyote Creek riparian mitigation site.

In January of 1997, flood events caused erosion in Reach 3 which destroyed the mainline irrigation crossing under the overflow channel near Riparian Site R-6, and the loss of approximately 120 plants at Riparian Sites R-1 and R-6. The mainline was repaired. In June of 1997, extension of Tasman Boulevard over Coyote Creek by the City of San Jose disturbed some of the Coyote Creek flood control project riparian forest plantings in Reach 3. Approximately 148 plants were lost in Riparian Site R-3. Replanting will be considered in 2000, if necessary.

2.2 CROSSOVER AREAS

In addition to riparian forest, there are several other types of plantings that have been included in the mitigation program: crossover, setback, and shade plantings. Crossover areas are locations where rock reinforcement along the streambank is necessary to provide flood protection and erosion control. The purpose of the crossover plantings is to provide low herbaceous cover for movement of small wildlife along the riparian corridor where trees have been permanently removed. The height of the vegetation at crossover areas is controlled in order to avoid blocking flood flows.

2.2.1 Mitigation Design and Maintenance

In Reach 2, four locations (0.7 acres) were planted as crossovers in 1992 and 1994. Including both banks of the creek, these crossover areas are referred to as Crossover Sites 2-1, 2-2, 3-1, 3-2, 4-1, 4-2, 5-1, and 5-2 (Table 6). Typical plants included California blackberry, western goldenrod, and mugwort. In Reach 3, an additional 0.4 acres is designated for planting at a crossover site (C-1) and a similar site referred to as a rock wall (W-1). The rock wall occurs along the east bank of Coyote Creek for approximately 650 feet upstream of Highway 237. A terrace was designed midslope of this rock revetment type structure to allow plantings in a manner similar to the crossovers. Floodwaters during the fall and winter of 1996/97 washed out the original substrate at these Reach 3 structures, and the Corps—Sacramento did not require its revegetation contractor to plant these sites. The District is encouraging the Corps to reconsider planting of these areas.

2.2.2 Monitoring Program

There are no requirements for monitoring of the crossover areas in Reach 2, nor were success criteria established. Plant counts were conducted at several of the Reach 2 crossover sites (Crossover Sites 2-1, 2-2, 3-1, and 3-2) in 1992 and 1993 (years 1 and 2), and percent cover was monitored at these locations in 1994 (year 3). The Reach 3 mitigation and monitoring plan prepared for the Corps permit required percent canopy cover monitoring of the Reach 3 crossovers in years 1 through 5, and established a success criteria of 70 percent absolute cover or greater by year 5.

2.2.3 Monitoring Results

Percent survival in the first 2 years of Crossover Sites 2 and 3 was over 90 percent, and many species spread rapidly across the site from their original locations. By year 3, these sites had 57 to 95 percent cover. (Jones & Stokes Associates, 1994, and District and Jones & Stokes Associates, 1995). Currently, Crossover Sites 2 and 3 have been observed to have approximately 100 percent cover, and vegetation has spread onto the rock faces below and above the planted terrace.

Additional quantitative monitoring of the Reach 2 crossover sites is considered unnecessary, as these sites have met their goal of providing low cover for movement of small wildlife along the riparian corridor. On an annual basis, the District inspects the crossover sites and, occasionally, needs to remove young woody trees that have established in the crossovers and would otherwise obstruct flood flows.

2.3 SETBACK AREAS

Setback areas are narrow strips planted with riparian trees and shrubs to expand the width of and buffer the mature, undisturbed, riparian forest (Table 6).

2.3.1 Mitigation Design and Maintenance

In Reach 2, 1 acre of setback area was planted in 1992 and 1993 at 13 locations; these sites were mostly scattered throughout the reach where historical lands uses or construction of the flood control project left bare areas. Many different types of trees and shrubs were planted, such as Fremont cottonwood, box elder, California blackberry, western aster, and western goldenrod. Two additional acres of setback areas were planted in Reach 3 in 1996 in a continuous strip along with the riparian forest discussed above. No distinction was made between land specifically planted as riparian forest and setback areas in Reach 3; rather, the 2 acres required for setback mitigation were added to the total acreage planned for riparian forest mitigation in Reach 3.

2.3.2 Monitoring Program

There are no requirements for monitoring of the setback areas, nor were success criteria established. Plant counts of the Reach 2 setback areas were conducted in 1992 and 1993 (years 1 and 2). Percent cover was monitored at most of these locations in 1994 (year 2 for some sites and year 3 for others), at two of the larger setback areas in 1996, and at one of the setback areas in 1998. Plant counts were included in the Reach 3 setback areas as part of the Corps—Sacramento riparian forest monitoring in that reach.

2.3.3 Monitoring Results

For the Reach 2 setback areas, the survival rate in 1993 ranged from 54 to 100 percent. Overstory cover ranged from 0 to 51 percent in 1994, from 60 to 71 percent in 1996, and at 66 percent for the one site monitored in 1998 (Tables 8, 9, and 10). Refer to the Reach 3 riparian forest section above for a discussion of how the included Reach 3 setback areas performed.

2.4 PROPOSED MANAGEMENT MEASURES FOR RIPARIAN REVEGETATION SITES

- We recommend a consolidated vegetation and wildlife monitoring effort be undertaken in the year 2001 at all the riparian forest revegetation sites, which would be year 15 for the pilot site, year 8 for Site 6-1, and year 5 for the Reach 3 sites. Thereafter, the vegetation and wildlife monitoring should be undertaken on all sites on the 5- and 10-year schedule described above.

- Based on its observations from work in 1998, the District should decide whether to continue to control the growth of coyote brush in the southern portion of Riparian Site 6-1 to facilitate the development of a diverse habitat at this location.

- The Reach 3 riparian sites damaged by floods and construction of the Tasman extension should be reexamined to determine if replanting is necessary.

2.5 REFERENCES FOR RIPARIAN REVEGETATION

Jones & Stokes Associates, *Coyote Creek, Reaches 1b and 2a, 1992 and 1993 Establishment Period Final Vegetation Monitoring Results for Revegetation Sites*, April 29, 1994.

Santa Clara Valley Water District, *Coyote Creek Reach 3, Mitigation and Monitoring Program, Cities of San Jose and Milpitas, Santa Clara County, California*, July 1, 1994.

Santa Clara Valley Water District and Jones & Stokes Associates, *Coyote Creek, Reaches 1b and 2a, 1994 Vegetation Monitoring Results for Revegetation Sites*, 1995.

Santa Clara Valley Water District, *Lower Coyote Creek Flood Control Project, Reaches 1 Through 3, (Dixon Landing Road to Montague Expressway, Cities of San Jose and Milpitas, California), Annual Report of Mitigation and Monitoring Programs, 1994-1995*, March 1996.

Sierra View Landscape, Inc., *Detailed Plan for the Riparian Revegetation and Maintenance, Coyote Creek Reaches 3a and 3b, Santa Clara County, California*, May 1996.

Sierra View Landscape, Inc., *First Year Monitoring Report for Riparian Revegetation and Maintenance, Coyote Creek Reaches 3a and 3b, Santa Clara County, California*, April 30, 1998.

Sierra View Landscape, Inc., *Second Year Monitoring Report for Riparian Revegetation and Maintenance, Coyote Creek Reaches 3a and 3b, Santa Clara County, California*, June 25, 1999.

U.S. Army Corps of Engineers—Sacramento District, *Request for Proposals, Riparian Revegetation and Maintenance, Coyote Creek Reaches 3a and 3b, California*, August 1995 (and Amendments Through December 1995).

U.S. Army Corps of Engineers—San Francisco District, Permit No. 20178S12, as Modified September 7, 1994.

SECTION 3. RIPARIAN WILDLIFE MONITORING

As mentioned in the preceding section, one of the goals of the riparian forest mitigation is to replace wildlife habitat. Wildlife monitoring of the riparian forest focuses on trends of wildlife populations as the revegetation sites age and comparing the abundance, diversity, and wildlife use of the revegetation sites with that of the adjacent riparian corridor. Scientific names for wildlife species are provided in Table 1.

3.1 MITIGATION DESIGN AND MAINTENANCE

The design of the riparian forest mitigation sites is described in the preceding section. During November of 1996, the overflow channel was mowed in Reach 2. This was the first time the Reach 2 overflow channel was mowed since its 1989 construction. The periodic removal of vegetation in the overflow channel was part of the original design of the flood control project and was accounted for in the Habitat Evaluation Procedures which evaluated the impact of the project to wildlife (USFWS, 1986 and Miller, 1986).

3.2 MONITORING PROGRAM

The original requirements for monitoring riparian wildlife for this project were very general with conditions for frequency of monitoring, but no specific conditions regarding the methodology. This subsection describes the original requirements for wildlife monitoring, and the current monitoring methods that have been used over the last reporting period.

3.2.1 Original Monitoring Methods

The 1988 EIS requires that vegetation and wildlife be monitored on one riparian forest site (the pilot revegetation site, also referred to as Riparian Site 5-4) on an annual basis for 10 years, and then every 5 years for the first 15 years, and once every 10 years thereafter for the life of the project (100 years). For the other riparian forest revegetation sites (Site 6-1 in Reach 2 and Sites R1 to R-6 in Reach 3), the monitoring frequency is every 5 years for the first 15 years and once every 10 years thereafter for the life of the project. The monitoring results will be reported for all revegetation sites in years 5, 15, and 55. Other environmental analyses and approvals for the Reach 2 project require a slightly different monitoring program; however, the program included in the 1988 EIS is the most comprehensive and, therefore, is considered the definitive requirement. No specific methods or success criteria were established for monitoring of riparian wildlife.

The Reach 3 wildlife monitoring requirements are more detailed than those required for Reach 2. A mitigation and monitoring program was prepared by the District in 1994 for a permit from the Corps—San Francisco for construction of the Reach 3 portion of the flood control project (District, 1994). This program requires a similar monitoring frequency as established for Reach 2 (5-year intervals for 15 years, and then every 10 years for the life of the project); however, it specifies methods for monitoring wildlife in Reach 3. The program focuses on the monitoring of birds in both the revegetation area and the adjacent riparian corridor, with some time spent monitoring small mammals, reptiles, and amphibians.

The three methods to monitor bird use of the riparian forest in Reach 3 are twice monthly point counts, weekly mist netting, and breeding bird censuses from February through July. Sampling for small mammals requires quarterly monitoring with live-traps set out for 5 consecutive nights. One-hour searches in 50 square meter areas will also be undertaken March, April, May, and June to determine the presence of amphibians and reptiles. While the Reach 3 project is under initial installation and 3 years of maintenance with the Corps—Sacramento contractor, there are no requirements for wildlife monitoring.

Wildlife monitoring will not be required at Reach 3 until year 3 (2001) and is not further discussed in this report.

3.2.2 Current Monitoring Methods

For 10 years (1987 to 1998), the District contracted with CCRS, a nonprofit research organization, to conduct wildlife monitoring at the pilot revegetation site in Reach 2 on a July 1 to June 30 annual basis. CCRS conducted point counts, mist net transects, and breeding surveys for birds; small mammal trapping; and surveys for reptiles and amphibians. Some vegetation monitoring was also conducted on an annual basis to correlate wildlife results with habitat characteristics.

CCRS monitored three habitat types: the existing riparian corridor, the riparian forest revegetation sites (pilot revegetation site and Riparian Site 6-1), and the overflow channel. The existing riparian corridor is a riparian forest along Reach 2 of Coyote Creek, which was not disturbed by construction of the flood control project. We estimate this forest is approximately 50 to 150 years old and has experienced minor disturbance over the past few decades from the adjacent farming activities and flood control maintenance (Elsey et al., 1993 and District, 1984). We refer to this relatively natural area throughout this section of the report as the riparian corridor to contrast it with the more recently-planted revegetation sites. Monitoring of the overflow channel is not required and will not be discussed in this report unless it provides some insight to the monitoring data at the revegetation sites. District staff took over the small mammal, reptile, and amphibian monitoring in 1996.

This report will discuss wildlife monitoring in years 8, 9, and 10 for the pilot revegetation site (1994 through 1996) and years 2 and 3 (1995 and 1996) for Riparian Site 6-1. Although monitoring was not required at Riparian Site 6-1 until year 5 (1998), the site exhibited such extensive growth, the District decided to include some early years of wildlife monitoring to track wildlife use, especially in comparison to the riparian corridor and pilot revegetation site. Sampling at Riparian Site 6-1 did not start until November 1995, thus it is not represented for the full 12 months in the July 1995 to June 1996 monitoring year. As discussed below, some changes were made in the monitoring methods since the last reporting period. Figure 6 shows the location of the point counts, mist net transects, and mammal trapping sites in Reach 2.

3.2.2.a *Birds*

For point counts, CCRS established four permanent point count census plots in each of the riparian corridor, the pilot revegetation site, and Riparian Site 6-1. All birds were observed at each plot for an 8-minute period at a frequency of two times per month. Point count monitoring is intended to assess the more visible and vocal birds.

For mist net surveys, CCRS established mist net transects in the riparian corridor, the pilot revegetation site, and Riparian Site 6-1. Nets were operated one morning per week for the entire year except on days with adverse weather conditions. Mist netting is intended to provide information on a greater range of birds including those that are more secretive and not easily observed under the point count method.

Two 5-meter transects on either side of the mist net were surveyed for understory and overstory vegetation, including cover percentages, canopy closure, and vertical canopy closure. This vegetation monitoring was not designed to characterize the vegetation across the entire site; however, it could be used to examine possible relationships between bird species captured in nets and the habitat type occurring directly adjacent to the net.

Breeding birds censuses were conducted one morning in each of the months March through June. A biologist walked through 16 one-hectare plots which extended across the riparian corridor, the pilot revegetation site, and Riparian Site 6-1. The biologist noted the number and species of singing male birds or female birds if no male birds were present.

3.2.2.b *Small Mammals*

CCRS monitored small mammals (and reptiles and amphibians as described below) at the pilot revegetation site through monitoring year 8. Sixty Sherman live traps were placed on a quarterly basis (September to October, December to January, February to March, and May to June) in the riparian corridor and in the pilot revegetation site for 3 consecutive nights. This effort equaled 1,440 total trap nights per year.

This program was taken over by District staff in years 9 and 10. To allow for comparison of data from year to year, the District changed the monitoring methods for small mammals (and reptiles and amphibians as described below). Although this means that data collected in 1996 and subsequent years cannot be directly compared to data collected in previous years, this new method allows more accurate determination of species present, number of individuals, and relative frequency.

Under the District program, 100 Sherman live traps were placed in September 1996 and April to May 1997 in the pilot revegetation site (years 9 and 10) and Riparian Site 6-1 (years 2 and 3) over 5 consecutive nights. This equals 500 total trap nights per year. No trapping occurred in the riparian corridor. There were also incidental captures of small mammals during the June, July, and November 1996 and April to May 1997 reptile and amphibian monitoring.

3.2.2.c *Amphibian and Reptiles*

Procedures for monitoring amphibians and reptiles have changed several times and, as a result, statistical comparisons with earlier years cannot be made. During the first 2 years of the study (1987 to 1988), drift fences and pitfall traps were used to study amphibian and reptiles. From 1989 to 1995, a time-constrained search method was used 1 day per month from February or March through June, and consisted of one-half hour midday searches of fixed 0.5 hectare plots. In 1996, the drift fence and pitfall trap method was reinstated. The drift fences were constructed of 18-inch aluminum flashing in a "Y" configuration which was buried between 6 and 9 inches in the soil. At the end of each 50-foot arm and in the center of the "Y," a 5-gallon bucket was buried to act as a pitfall trap. No pitfall traps or funnel traps were used along the drift fences. Vegetation was temporarily cleared from the drift fences and traps. Pitfall traps were left in an open configuration without covers during the trapping effort.

Pitfall traps were opened for 10 consecutive nights starting on June 25, 1996; November 19, 1996; and April 28, 1997. Traps were checked twice each day during the April and June surveys, and once per day during the November survey. Amphibians and reptiles captured in the traps were identified to species and released.

3.3 RESULTS

3.3.1 Birds

Year-round resident, breeding, wintering, and migratory birds use the study area (riparian corridor, riparian forest revegetation sites, and adjacent overflow channel). The study areas, and the revegetation sites in particular, provide good habitat for winter resident birds, primarily White-Crowned Sparrow and Golden-Crowned Sparrow. Other research indicates that large numbers of birds pass through and use this area as a refueling site during migration (i.e., the birds deposit fat while making multiday stopovers) (Otahal, 1994; Otahal, 1995; and Otahal and Kaiser, in preparation). One migrant which was captured in substantial numbers, the Yellow Warbler, is a California species of special concern. Table 16 summarizes the bird monitoring data from these 3 years. As further discussed below, direct comparisons between years may not be accurate, but some patterns can be observed.

For mist net monitoring, sampling effort varied between sites in any 1 year because of weather conditions and a slightly lower number of nets in the riparian corridor. Data adjustments were made to create equivalent sampling efforts to allow comparison of data between sites in any one year. However, because different adjustments were used in different years, and because sampling effort varied somewhat between years, data between years cannot be directly compared. The 10-Year Summary Report of bird monitoring on the pilot revegetation site (due for completion in 2000) will make consistent adjustments based on sampling effort so that data can be compared between years, and trends can be more closely analyzed.

For breeding bird surveys, density estimates were made by calculating the number of pairs per unit area surveyed. See Table 17 for a summary of the annual bird breeding counts. Because of their standardized size, most of the breeding bird plots extended beyond any one specific site and, therefore, breeding bird data in most years cannot be readily compared between the revegetation sites and the riparian corridor. However, this data can be used to compare overall use of the sites by breeding birds. In 1996-97, the location of breeding birds was distinguished during the surveys to identify whether the bird occurred in the existing riparian habitat, revegetation, or other sites. Thus, breeding bird data for the 1996-97 monitoring year can be analyzed according to location.

An analysis of the bird data by guilds was also conducted to indicate how the sites were being utilized. Each bird species was characterized as belonging to a guild which represents its major foraging strategy (Ehrlich et al., 1988). Comparing guild relationships of the revegetation sites with those of the riparian corridor and tracking guild trends between years may be particularly relevant for this project as it can indicate if the revegetation sites are providing habitat for wildlife species associated with riparian habitat. In particular, patterns in the foliage gleaning guild should be of interest, since this guild is composed predominantly of riparian associated birds such as warblers, thrushes, chickadees, and kinglets.

3.3.1.a *1994-95*

For the 1994-95 monitoring year, the number of individual observations of birds in the point count data was statistically equivalent between the riparian corridor and the pilot revegetation site; however, the number of species was statistically greater in the riparian corridor. For the mist net data, the number of observations and number of species were higher in the pilot revegetation site. This may indicate that the pilot revegetation site plays a greater role in supporting migrants, which tend to show up more in the mist net surveys.

The foliage gleaners and ground gleaners dominated both the number of observations and number of species at both the pilot revegetation site and the riparian corridor, which suggests that these sites have structural similarities. The three most commonly observed species in the riparian corridor were House Finch, Song Sparrow, and Common Bushtit. The three most commonly observed species in the pilot revegetation site were American Goldfinch, Song Sparrow, and House Finch.

For the 1994-95 mist net data, the pilot revegetation site showed significantly higher numbers of species captured during the peak neotropical migratory period (August to October and April to June), but no such pattern was apparent in the riparian corridor.

of a source population. The Dusky-Footed Woodrats were captured in the pilot revegetation site, which is adjacent to mature riparian forest. Those species that are present may be adapted to this type of disturbance regime and capable of recolonizing the sites following a disturbance such as a flood. In addition, sites supporting early successional species are present in the immediate vicinity of the revegetation sites and include the sewage treatment plant and adjacent farmland.

3.3.3 Amphibians and Reptiles

In the 1994-95 monitoring year, 45 Western Fence Lizard and 1 Gopher Snake were observed during the time-constrained searches in the pilot revegetation site. Nine Western Fence Lizards were observed in the riparian corridor.

Fifty-three reptiles were captured or observed during 1996 (Table 19). Forty-six reptiles were captured or observed during the June to July trapping period and seven were captured or observed during the November trapping period. The most common species captured was the Western Fence Lizard with 36 captures, followed by the Southern Alligator Lizard with 10 captures or observations, and 1 Northern Alligator Lizard. Two small Gopher Snakes and one Coast Garter Snake were captured in pitfall traps. One Racer was observed on site and one Gopher Snake was picked up as road kill at the site. No Southwestern Pond Turtles were observed on site, but they have been reported using Coyote Creek immediately adjacent to the site[4]. No amphibians were captured in the pitfall traps; however, Pacific Tree Frogs were heard throughout the revegetation sites.

Forty-eight reptiles were captured or observed during 1997 (Table 19). The most common species captured was the Southern Alligator Lizard with 32 captures/observations followed by the Western Fence Lizard with 13 captures/observations. No snakes and no amphibians were captured during this trapping effort. No Southwestern Pond Turtles were observed.

The change in methods from time-constrained searches to drift fences with pitfall traps makes quantitative comparisons difficult, but species composition comparisons can still be made. The data collected during the first 5 years of the study are difficult to interpret because the methods are not clearly explained, and no sighting records or raw data are included in the report (Rigney, 1993). Starting in 1994, the reports indicate the number of individuals sighted during the time-constrained searches (Rigney et al., 1994 and Johnston et al., 1996). These data suggest the reptile community is dominated by Western Fence Lizards with few other species present. The methods used to collect this data may not have been the most appropriate to the habitat present in the revegetation sites. The time-constrained search method may be biased to highly visible and rapidly moving species such as the Western Fence Lizard. Slow moving or cryptic species such as the Southern Alligator Lizard may not be observed by this method. Other species, and in particular nocturnal species, are rarely observed using this method.

The most common species observed in or adjacent to the revegetation sites were the Western Fence Lizard and Southern Alligator Lizard and this is consistent with early observations. Despite timing our trapping efforts to capture amphibians, we were unsuccessful in these efforts. Nocturnal searches may be necessary to pick up amphibians using the site.

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[4] Personal communication, Chris Fischer, CCRS to Doug Padley.

The reptile and amphibian communities appear to be composed of only a few species. The reasons why this community is restricted to these few species is unknown but may be related to the lack of local populations from which the site can be colonized and due to the relative frequency, the site is inundated by high water.

The small mammal, reptile, and amphibian communities are all relatively small and undeveloped. This may be an indication of the sites supporting early successional stage vegetation or may be an indication that source populations from which to colonize the sites are not present. If the sites are characteristic of early successional stage riparian habitats, then the biological diversity is expected to change with time. If the sites are depauperate of species because of the lack of source populations from which to colonize the site, then the Lower Coyote Creek system must be considered impaired. If the system is biologically impaired by land uses within the creek corridor and on adjacent lands, then restoration efforts along the creek will be difficult to successfully implement and may be impossible at this time.

3.4 PROPOSED MANAGEMENT MEASURES FOR RIPARIAN WILDLIFE

- The current monitoring project was established without performance criteria and should not be used as a model for other monitoring regimes. The data gathered by this monitoring effort can be used to generate hypotheses and gather more information on the general trends of wildlife use in developing riparian revegetation sites.
- The proposed Reach 3 monitoring program should be reconsidered in light of the findings at the Reach 2 wildlife monitoring program. In particular, time-constraint searches for reptiles and amphibians may need to be replaced with some type of trapping program.
- CCRS has closed down as an organization. The District has negotiated with the San Francisco Bay Bird Observatory (including some of the former CCRS staff) to complete the 10-Year Summary Report of bird monitoring on the pilot revegetation site.
- We recommend a consolidated vegetation and wildlife monitoring effort be undertaken in the year 2001 at all the riparian forest revegetation sites, which would be Year 15 for the pilot site, year 8 for Site 6-1, and year 5 for the Reach 3 sites. Thereafter, the vegetation and wildlife monitoring should be undertaken on all sites on the 5- and 10-year schedule described above.

3.5 REFERENCES FOR RIPARIAN WILDLIFE

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SECTION 4. FISHERIES MITIGATION

To compensate for potential impacts to fisheries, a number of measures have been incorporated into the construction and mitigation phases of the Lower Coyote Creek flood control project. The design of in-stream structures were modified to allow fish passage or create fish habitat, spawning gravel is installed, migration of salmonids is monitored, and aquatic shade sites have been planted. These measures are discussed in subsections below. Standish Dam was included in the flood control project as a fisheries mitigation measure and is discussed separately in the next section. Some reference between this section and the next section is necessary for a comprehensive understanding of the status of fisheries mitigation on Lower Coyote Creek.

Fisheries mitigation was not originally addressed in the 1984 EIR. In response to regulatory concerns, the District commissioned a fisheries investigation in 1987. This investigation included habitat surveys, water quality measurements, and fish sampling in the spring, summer, and fall of 1987. The fisheries habitat in Lower Coyote Creek was evaluated as degraded as a result of surrounding urbanization and the manipulation of the streamflow by Anderson Reservoir at a watershed level. However, salmonids were collected in Lower Coyote Creek upstream of Standish Dam, so the investigators concluded that Reach 2 provided steelhead rearing habitat and a migration pathway.

As a result of the 1987 investigation, the Lower Coyote Creek Fisheries Evaluation Report was prepared with recommended measures to mitigate for the potential impacts of the flood control project to fisheries (Smith et al., 1989). These recommendations included: dredging tidal channels along the inside of the abandoned salt pond, creating a delta configuration upstream of Standish Dam, installing a baffle system in the concrete-lined channel beneath Highway 237, placing large boulders as escape cover for fish, creating a rock-lined channel downstream of Montague Expressway for riffle habitat, replacing spawning gravels, planting riparian vegetation along bare banks to create additional shade, and moving Standish Dam to a location downstream of its original location.

A mitigation and monitoring program was prepared by the District in 1994 for a permit from the Corps—San Francisco for construction of the Reach 3 portion of the flood control project. This program incorporated and refined those original recommendations made in the Fisheries Evaluation Report relevant to Reach 3.

4.1 REACH 3 FISH STRUCTURES AND DESIGN MODIFICATIONS

The Fisheries Evaluation Report recommended several design modifications to flood control project to better accommodate fisheries. These design modifications were incorporated into the final design and installed with the different phases of the project. Subsequent to their installation, many of these features do not require additional monitoring.

4.1.2 Mitigation Design and Maintenance

During construction of the Reach 3 flood control project in 1995, the following fisheries passage structures were installed: a Washington baffle in the concrete channel underneath Highway 237, boulder clusters at the crossover area, and a low-flow channel in rocked sections of the creek. As requested by the CDFG, the low-flow channels were redesigned to contain a water depth of 1 foot at an estimated summer low-flow of 5 cubic feet per second, based on summer streamflow measurements taken in 1994.

4.1.3 Monitoring Program

As provided for in the Reach 3 mitigation and monitoring program, the integrity of the fish passage structures (Washington baffle, low-flow channel, and boulder clusters) will be inspected by a qualified civil engineer prior to September 1 of each year. Any remedial measures necessary to return the facilities to their original functional design will be completed by September 30 of that year.

From October 1 through the following March 31, visual inspections will be made of the entire concrete-lined section in Reach 3 to ascertain that the Washington baffle and low-flow channel are free of debris, siltation, or other problems that would block upstream migration of adult salmon and steelhead. Debris or other problems should be remedied as soon as possible. These inspections will occur once every 2 weeks, unless there have been no storm events since the last inspection in which case they will occur at least once every 4 weeks.

Requirements for monthly surveys for the presence of adult salmon or steelhead migrating upstream are described below with the spawning gravel subsection. These surveys will also indicate whether the fish passage structures are working.

The annual inspection by an engineer, the biweekly winter inspections for debris, and any necessary remedial measures will occur every year for the life of the project and will be reported on an annual basis to CDFG, the Corps, and any other regulatory agency at their request. The frequency of the reporting can be reduced to once every 5 years or any other frequency considered appropriate at the end of 10 years or at any other time with the concurrence of CDFG and the Corps—San Francisco.

4.1.4 Monitoring Results

District staff has inspected the structures for structural integrity, and no retrofits or repairs have been necessary. The structures are also inspected during the winter to determine if they are blocked by debris. The turbidity of the winter flows is often too high to determine whether the low-flow channels and baffle are silted in.

During August 1999 inspections, District fisheries biologists noted that the Washington baffle at Highway 237 was covered with tarps and boards as part of the water diversion through and around construction retrofits of Highway 237 by the California Department of Transportation. As a result, the fisheries biologists were not able to see nor inspect the baffle; however, adult salmon were found the following days in a fish trap operated upstream of the baffle, so the baffle appears to be open to fish passage.

4.2 SPAWNING GRAVEL

A program to place spawning gravel in Reach 3 has been established to replace salmonid spawning riffle habitat which was removed by construction of the rock lining downstream of Montague Expressway.

4.2.1 Mitigation Design and Maintenance

The mitigation and monitoring program for the Reach 3 Corps permit requires replacement of 3,060 cubic feet of gravel at a depth of 1 to 2 feet. The replacement gravel is to be ½-inch to 2½-inch diameter rounded washed river gravel mixed with approximately 25 percent white tracer gravel. Two locations near Montague Expressway were originally selected (approximately 0.1 and 0.9 miles downstream of Montague Expressway). Provisions were made for selecting new sites with the concurrence of CDFG to adjust to changing stream conditions which best suit spawning requirements. Gravel replacement is to continue in future years if gravel embeddedness is greater than 15 percent, gravel depths are less than 1 to 2 feet, or gravel volume has been reduced greater than 35 percent from the previous year. Gravel replacement is to occur prior to September 30 of any monitoring year when spawning gravel conditions have been found to be inadequate.

The spawning gravels were originally placed in Reach 3 downstream of Montague Expressway in 1995. Additional spawning gravels were placed at the same location in 1996 and 1999.

The hydrologic conditions at the gravel placement location downstream of Montague Expressway do not appear to be suitable for maintaining good spawning conditions, since these gravels become embedded with silt every year. In 1997 and 1998, the District's fisheries biologists surveyed the Reach 3 creek corridor and found other potential gravel placement locations which appear to have better hydrologic conditions. However, the loader equipment which the District uses to place the gravel in the stream could not be used at these locations because there is no nearby road access (former dirt roads along the creek have deteriorated), and the streambank is densely covered by riparian trees. In September 1999, the District contracted to have vacuum-type equipment (operated from the top of the new levee road) transfer gravel through pipes placed between the bank trees to the proper location in the stream channel at a location upstream of the new Tasman Drive overcrossing. Margaret Roper, the CDFG regional fisheries biologist, approved of the new location and technique. This new method allows better access to remote sites, protects bank vegetation, and should reduce the amount of turbidity that occurs during the placement of gravel in the stream bottom. We look forward to experimenting with this technique and the possibility that it may be useful on other streams.

4.2.2 Monitoring Program

After the winter flood season and prior to September 1 of each year, the volume and quality of the spawning gravel are to be evaluated to determine if replacement of gravel is necessary to bring the volume or quality up to the original target amount. Spawning surveys are to occur once monthly in October through April (unless there have been no storm events since the last inspection) to observe migrating adult salmon and steelhead, locate any spawning activity and redds, and determine if the replacement spawning gravels are being utilized. Evaluation of spawning gravel, gravel replacement (if required), and spawning surveys will occur for 10 years (1996 through 2005). Annual reports will be submitted on the results of these surveys and any actions taken. At the end of 10 years or at any other time, with the concurrence of CDFG and Corps—San Francisco, the frequency of the annual assessments, actions, and reports can be reduced to once every 5 years or any other frequency considered appropriate.

4.2.3 Monitoring Results

In the fall/winter of 1995/96, a few months after installation of the fish passage structures and spawning gravels, two salmon redds were identified in Reach 3, one occurring in the spawning gravel placed by the construction project. No spawning redds have been observed in Lower Coyote Creek since that date; however, during the winter the water turbidity is so high, it is difficult to clearly see the conditions of the channel bottom and gravels.

4.3 AQUATIC SHADE SITES

The purpose of aquatic shade sites is to provide shade and overhanging cover along the creek banks to improve fish habitat in replacement of streamside trees which were removed during construction of the flood control project. The Fisheries Evaluation Report recommended the planting of 2,665 linear feet of streambank as aquatic shade. After construction of the flood control project, field conditions were resurveyed to determine the best locations for aquatic shade sites. Subsequently, six sites were planted in Reach 2, and four sites were planted in Reach 3 with a total of 7,160 linear feet (approximately 3 acres).

4.3.1 Mitigation Design and Maintenance

From 1991 through 1994, 3,190 linear feet of shoreline (1.9 acres) were planted for aquatic shade in Reach 2 at Riparian Sites 2-2, 3-1, 4-1, 4-2, 5-9, and 7-1 with tree species that grow rapidly and shade the creek, primarily Fremont cottonwood and willows. In Reach 3, 970 linear feet (1.2 acres) were planted for aquatic shade in 1996 and early 1997, at Sites S-1, S-2, S-3, and S-4, primarily with Fremont cottonwood, willow, box elder, and California blackberry.

Although not designated as an aquatic shade site in the Fisheries Evaluation Report, Riparian Site 1-1, an island in the delta area of Reach 1B, was specifically planted in 1991 with trees to provide shade to the main channel of the creek.

4.3.2 Monitoring Program

To comply with a condition of the Corps permit for the construction of Reach 2 of the flood control project, the District established a program for monitoring the development of shade levels along the creek (Lapaz et al., 1990). This program was submitted to the agencies for their review and approval in 1991. This monitoring program utilized the SSShade model (developed by the USFWS) to quantify changes in shade caused by construction and the subsequent planting of aquatic shade sites, and to determine when shade was restored to preproject levels. The SSShade model combines 14 parameters that influence shade, including the height and density of riparian vegetation, to estimate daily average shade.

Based on the unsatisfactory experience with the SSShade model in Reach 2 (discussed further below), no shade monitoring was recommended for the Reach 3 aquatic shade sites. Rather, the mitigation and monitoring program prepared for the Corps Reach 3 permit required that the Reach 3 aquatic shade sites be monitored for survival in years 1 through 3 and percent canopy cover in years 4 and 5 as with the riparian forest sites. Refer to the monitoring program discussion in the Riparian Revegetation section above for further details.

4.3.3 Monitoring Results

As discussed in the last monitoring report for this project (District, 1996), monitoring of shade levels in Reach 2 occurred from 1990 through 1993. Irregularities in the results, especially when compared with the observations of field personnel, indicated that computation of shade levels by the SSShade model was flawed. This model appears to relay on reestablishing nearly exact locations and conditions at the monitoring points from year to year, which is not possible at Coyote Creek where the depth of water and width of the stream varied from year to year, especially in relationship to conditions at Standish Dam. Therefore, the District desisted in directly monitoring shade at these sites, and instead concentrated on monitoring the survival and growth of trees on these sites.

Survival and growth of the trees at the Reach 2 aquatic shade sites have been good overall. In 1996, absolute cover of overstory vegetation ranged from 76 to 100 percent at Riparian Sites 2-2, 4-1, 4-2, and 5-9 (Table 9). In 1998, Riparian Site 4-2 had an absolute cover of overstory vegetation of 82 percent (Table 10).

The vegetation on Riparian Site 1-1, which is not one of the sites designated in the Fisheries Evaluation Report but was planted to shade the creek channel, has marginal conditions to support riparian trees. This site is an island on which 1.6 acres were planted to shade the main channel of the creek. This site had 43 percent absolute overstory cover in 1996, 32 percent in 1997, and 34 percent in 1998, with most of the trees concentrated along the shoreline. Visual qualitative observations indicate that the portions of the site away from the shoreline will not support trees, possibly because of existing elevated salinity in the groundwater and/or subsoils. This site is at the interface of tidal and fresh water in the creek. In the future, if a decision is made to no longer operate Standish Dam on a permanent basis (as discussed in the next section), this portion of the creek may convert to brackish marsh. Riparian Site 1-1 would no longer be able to provide, nor will there be a need for providing aquatic shade at this location.

In 1998 (year 2), survival of all installed plants at the Reach 3 aquatic shade sites S-1 and S-2 were 89 percent and 91 percent, respectively (Table 14). For S-3 and S-4, survival of the willow cuttings was 31 percent combined, whereas survival of tree species installed in containers (box elder, western sycamore, Fremont cottonwood, and oaks) was 78 percent. Additional plantings of willow cuttings at Sites S-3 and S-4 will be considered after 1999 monitoring is completed.

4.4 PROPOSED MANAGEMENT MEASURES FOR FISHERIES MITIGATION

In the last monitoring report for this project, the District requested that permit requirements for conducting a shade monitoring program be deleted because the SSShade model was not working. Since accurate measurements of preproject shade levels were not taken, implementation of another shade monitoring technique would be highly subjective, and it would be difficult to evaluate actual postproject changes. Therefore, the District did not recommend that the SSShade model be replaced with another method for directly measuring shade, but did offer to monitor the survival and growth of shoreline trees at these sites as a substitute. Establishment of shade trees at these sites has been good for most sites; therefore, the District again is requesting the agencies to approve the elimination of the SSShade model.

4.5 REFERENCES FOR FISHERIES MITIGATION

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SECTION 5. STANDISH DAM

Standish Dam is a seasonal structure that has been placed across Lower Coyote Creek near Dixon Landing Road most years during the summer to exclude tidal waters.

5.1 HISTORY OF STANDISH DAM

5.1.1 Farmers' Dam

Local farmers first constructed a dam in 1932 in this section of the creek. The District has records of the dam being installed in 1947, 1954, 1955, 1958, 1961, 1963, and 1964. During these years, we believe the dam was primarily installed during the summer; it may have been installed in intervening and subsequent years. The original dam site was upstream of the current location, and backed up water for approximately 4,500 feet to Jackson Dam, which was located approximately ½ mile downstream of Milpitas Road. In 1953, the District entered into an agreement with the property owners (Standish and McCarthy) along Lower Coyote Creek to "erect a dam with a permanent foundation but with removable flash boards for the purposes of keeping out saltwater and sewage back-wash from their lands, and for the purposes of impounding fresh water flowing[5]." This dam was operated on an annual basis from April to October until 1988 when it was removed to accommodate construction of the Reach 1 flood control project.

5.1.2 1984 Flood Control Design

When the District designed the Lower Coyote Creek flood control project in 1984, replacement of the farmers' seasonal structure was proposed at a location 1,300 feet upstream of the farmers' dam, and just upstream of the Milpitas pumping station (District, 1984). The Engineer's Report did not state why this location was chosen, however, because this section of the channel had a narrower cross section and was proposed to be lined with rock, these conditions may have also provided engineering advantages for the design of the dam. In response to comments on the 1984 EIR, the District indicated that the purpose of replacing the dam was to "limit saltwater incursion up Coyote Creek in dry summer months." The relationship of Standish Dam to fisheries was not addressed in the EIR.

The EIR noted that steelhead were not present in Coyote Creek and had probably been eliminated by severe pollution of San Francisco Bay in the 1950s. The EIR also noted that the flood control project would remove and realign a meander in the creek (near the current day location of the waterbird pond) which would result in the net loss of 2,000 feet of channel with tidally-influenced freshwater marsh (emphasis added). The EIR proposed the creation of a delta-like network of channels and islands at the upper end of Reach 1A as mitigation for the loss of this tidally-influenced meander. The authors of the EIR stated that "freshwater marsh vegetation (bulrushes and cat-tails)" would naturally develop in this delta area. It is curious to note that this freshwater marsh was proposed at a location **downstream** of the proposed location of Standish Dam. We are not clear whether conditions in the early 1980s indicted that although tidally-influenced, this section of Lower Coyote Creek would have freshwater conditions even though it was downstream of Standish Dam, or whether this was an oversight in the EIR evaluation.

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[5] Aguilera, Joe, History of Standish Dam, March 1998. This historical information is from various files at the District and may not be complete.

Comment letters from agency personnel on the EIR and subsequent EISs expressed concern that the project did not adequately address potential impacts to fisheries, conversion of freshwater habitat to brackish habitat, and possible problems associated with the location and design of the seasonal dam.

5.1.3 Fisheries Evaluation Report

In response to these regulatory concerns, the District commissioned a fisheries investigation (Smith et al., 1989). This investigation included habitat surveys, water quality measurements, and fish sampling in the spring, summer, and fall of 1987. The fisheries habitat in Lower Coyote Creek was evaluated as degraded as a result of surrounding urbanization and the manipulation of the streamflow by Anderson Reservoir at a watershed level. However, salmonids (one rainbow trout/steelhead partial smolt in May, three rainbow trout/steelhead in August, and two rainbow trout/steelhead in October) were collected upstream of the Standish Dam. Salmonids were also present downstream of the dam during the same months (three rainbow trout/steelhead smolts in May, one rainbow trout/steelhead in August, and five Chinook salmon and one rainbow trout/steelhead in October). The Lower Coyote Creek Fisheries Evaluation Report summarized the 1987 surveys and made recommendations regarding redesign of the flood control project to address fisheries mitigation. The authors of this report concluded that Reach 2 provided steelhead rearing habitat and a migration pathway for salmonids.

A reevaluation of the 1987 data, however, may come to different conclusions. In the summer and fall of 1997, streamflow in Coyote Creek was abnormally high since Anderson Reservoir was being drawn down for earthquake repairs. The higher than normal streamflow could have drawn salmonids into the lower Coyote system outside of their normal migratory season and/or maintained lower than normal water temperatures which were suitable for salmonids. As a result, it is unclear whether the observation of salmonids in 1987 indicate Reach 2 was suitable rearing habitat for steelhead, or whether sampling in that single year was not representative of normal conditions prior to the construction of the flood control project.

The Fisheries Evaluation Report recommended the seasonal dam be relocated downstream of the delta channels. This location would be downstream of the location proposed in the EIR and approximately 1,200 feet downstream of the location of the farmers' dam. Relocating the dam further downstream would create more freshwater lake habitat as suitable salmon and steelhead rearing habitat; however, it also would eliminate tidal channel habitat for euryhaline fish. To compensate for the subsequent loss of tidal channel, the report recommended that tidal action be improved to 4,710 linear feet of existing dredged channels along the inside of the abandoned salt pond in Lower Coyote Creek. To meet this mitigation requirement, abandoned salt pond levees were lowered as part of the construction of Reach 1 of the flood control project. No monitoring was required of the new tidal channel; however, recent field and aerial observations of the abandoned salt pond show development of tidal channels and establishment of bulrush.

The Fisheries Evaluation Report also recommended the recently-excavated main channel in the vicinity of the dam be narrowed, steeper side slopes created, and the banks be revegetated with willows and Fremont cottonwood to create better freshwater habitat for salmonids. This design was installed during construction of Reach 1, and trees were planted along an island on the west side of the main channel in 1991 (Riparian Site 1-1). See the previous section for more discussion of vegetation on this island.

The Fisheries Evaluation Report made several recommendations regarding the design and operation of the new dam. The dam was to be operated only from May through October to prevent blocking upstream migration of fish. The design would include concentration of flow through the dam to provide for downstream migration of fish. This report specifically stated that a fish ladder was not required. It recommended that the dam be designed to exclude tidal flows of 6.8 feet and to pond freshwater at an elevation of 6.0 feet, but not higher to prevent flooding of the adjacent road.

Off-site mitigation measures were considered in the Fisheries Evaluation Report (improving access for spawning and improved flows for rearing or outmigration in Upper Penitencia Creek or Upper Coyote Creek). These were considered infeasible because they could not provide consistent streamflow conditions for spawning, rearing, and outmigration in the upper sections of these creeks, and because they would not prevent potential loss of riparian habitat in Lower Coyote Creek if the dam was no longer operated.

5.2 MITIGATION DESIGN AND MAINTENANCE

The District has developed several versions of both an earthen dam and a steel structure to meet the Standish Dam requirements. As described below, there have been a number of problems with these designs related to a combination of late or early storms, tidal conditions, design of water control structures, and difficulties or errors installing and removing the dam. Currently, a study is being conducted to determine the potential long-term impacts of discontinuing operation of Standish Dam.

5.2.1 Earthen Dam—1989 to 1994

From 1990 to 1994, the District installed an earthen structure at a location near the downstream end of the delta channels. This structure was installed every year at approximately May 15 and removed every year at approximately October 15. During these years, the earthen dam was redesigned several times to get the right configuration of culverts to allow bypassing of streamflow and exclusion of tidal waters.

The earthen dam has had consistent problems with timing, water quality, and fish passage. Appropriate low tides are not always available during daylight hours of the target work dates, and along with higher streamflows during wet years, can result in delays to installing the dam. Because of the loose nature of its material, no matter how carefully installed, an earthen dam will result in some turbidity to the creek channel during installation and removal. In the early years, CDFG stated they were not concerned with temporary turbidity during installation and removal of this dam because it was in a tidal area which tends to be turbid anyway. Later, concerns about turbidity increased, especially in years when work in the creek was not correctly timed with low tide.

The earthen dam was not well designed to facilitate fish passage, especially in a tidal area. Since it was considered a temporary structure until a steel structure could be designed, this problem was never adequately addressed. The May/October dates for installation and removal of the earthen dam were intended to avoid the fish migration seasons. However, weather patterns, which greatly influence the timing of fish migration, are not consistent year to year and make it difficult to plan and implement timely operation of the dam to avoid migration and coincide with the dry season. Upmigrating salmon were sometimes observed blocked by the dam in the late summer. For stability reasons, the earthen dam requires a width that is probably too wide for upmigrating fish to jump over even during high tide. In previous years, CDFG was reluctant to allow the District to remove the dam prior to mid-October to allow better access to upmigrating salmon. CDFG was concerned that removing the dam earlier might shock any steelhead fry which might have been rearing upstream of the dam and had not gone through smoltification.

Likewise, some conflicts with outmigrating steelhead could have been avoided by moving the target installation date after mid-May. However, there were concerns that installation later in the year might result in ponding of warmer water which would not have been suitable for steelhead. As designed, the only way for migrants to move downstream while the dam was in place was to pass through the flapgated culverts which may not have provided enough attractive pull and would have dropped fish into a shallow channel during low tides.

In many years, there were difficulties installing, operating, or removing the earthen dam. In 1990, the dam was installed around June 16. Saltwater was trapped upstream of the dam during installation and took several weeks to dissipate in deeper portions of the channel. Placing the dam's low-flow culverts at grade on the channel bottom and closing these culverts at the end of the low tide cycle were noted as two ways to minimize the amount of saltwater trapped in the lake during future installations. A fish kill in the freshwater lake upstream of the dam was also observed during that year. This fish kill occurred immediately after a late September rainstorm that may have caused problems with turbidity, pollutants, and biochemical oxygen demand (Stanley et al., 1991).

In 1991, the dam was installed on May 28 and 29. The slide gate on one of the lower culverts was left opened during several high tide cycles, and upper culverts were not fitted with flapgates. This again resulted in saline conditions upstream of the dam for some portions of the summer. Remedial actions were taken that year to close the lower culvert and retrofit the upper culverts with flapgates (Stanley et al., 1992).

In 1992, the dam was installed on May 13 and 14. In 1993, the dam was installed on May 5 and 6. In 1994, the dam was installed on May 25 through 27. There were no problems with trapping of salinity upstream of the dam in these years (Stanley et al., 1994).

5.2.2 Steel Dam—1994 and 1995

In 1994, a steel dam was constructed at a location approximately 450 feet downstream of the earthen dam. The steel structure was intended to resolve some of the problems with the earthen structure described above. This structure consisted of steel plates on a concrete foundation with a center V-notch and fish chute to allow downstream passage of fish at all times. The steel plates and fish chute would be installed and removed every year on a mid-May to mid-October schedule.

The steel structure was only operated for 1 year and had many problems. In 1995, the steel dam was installed on June 12 and removed on October 16. Installation of the dam was delayed until June because above normal precipitation in the spring of 1995 resulted in relatively high streamflows through mid-July. Because installation of the steel plates was difficult and took longer than expected, some work was completed as tides were rising. These conditions compromised the safety of crews and equipment. After installation of the dam, rainfall that occurred in June (outside of the normal rainfall season in California) caused streamflows to be higher than expected. This resulted in creek water flowing over the top and around the sides of the steel structure and flooding of the adjacent road from June 16 to 20. This is an undesirable condition since sheet flow over the top of the dam does not provide for safe downstream passage of fish. Water flowing onto the adjacent road caused streambank erosion where it reentered the creek further downstream. It also flowed into the waterbird pond, destroyed shorebird nests on the island in the middle of the pond, and disrupted maintenance of salinity levels in the pond. District crews opened slide gates in the steel structure during low tides for several days to lower the height of water ponding behind the dam.

Although the District has designed retrofits to the steel structure in response to these problems, their installation was halted in August 1998 as described further below.

5.2.3 Earthen Dam—1996 and 1997

Because of the problems with the steel dam and to allow time for retrofitting that design, the District returned to installation of the earthen dam in 1996. The dam was initially installed on May 10, but it washed out during a storm on May 16. The District had designed the earthen dam with two larger-sized culverts in 1996 and opened all the accessible slide gates as the intensity of the mid-May storm increased; however, the flows were too high and eroded the main portion of the dam and upper culverts. The dam was reinstalled on June 17 and 18.

In 1997, the earthen dam was originally installed on May 7 through 10, but washed out on May 23 and 24 during an unseasonably late storm. After checking the weather reports, on-site reports on streamflow, and tide charts, District staff decided not to open the slide gates in the earthen dam on May 23 because the rainfall was not believed to be enough to cause washout of the dam. Additionally, District staff was concerned about trapping saltwater behind the dam during high tides that evening. However, the dam did wash out the evening of May 23 and was subsequently reinstalled in June 10 and 11, 1997. CDFG staff was notified immediately when the washout was discovered on May 24, and other agency staff was notified over the next few days. The retrofitted dam was outfitted with flapgates on the downstream end of the bypass culverts to allow more flexibility if high flows again coincided with high tides.

On October 14, 1997, a District crew mistakenly removed Standish Dam during a rising tide, instead of during a low tide, as preferred. This resulted in a partial washout of the earthen structure which caused sedimentation in the creek and erosion of one stream bank. Agency staff was notified of the problem within a short period of time. The District subsequently conducted an investigation, and an evaluation was prepared (Ali-Adeeb, 1998). In response to recommendations made in this investigation, the District has revised the work order format for installation and removal of Standish Dam to include more detailed requirements of the jobs and to attach relevant permits, has developed pre and postconstruction checklists, and has presented the findings of the report to the District maintenance crews as a lesson on how to avoid similar problems on future projects.

5.2.4 1996 and 1997 Agency Meetings

Because of the frequent problems with Standish Dam, the District has requested several times that agency staff meet collectively to discuss the option of no longer operating the dam. On April 2, 1996, representatives of the Corps—San Francisco, U.S. Environmental Protection Agency (USEPA), USFWS, and CDFG met on site with District staff to review the effectiveness of Standish Dam as a fisheries mitigation measure, review groundwater response to seasonal changes in the creek, and discuss possible vegetative and wildlife changes if the dam was no longer operated. The consensus at that meeting was that the District should install Standish Dam in 1996; however, the monitoring program (as further described below) should be revised to provide additional information on the possible effects of no longer operating Standish Dam. Another agency meeting was held on June 14, 1996, to discuss the washout of the dam. Thomas Iwamura, the District's groundwater hydrologist, presented preliminary information on the response of shallow groundwater wells to seasonal ponding of the creek.

On March 27, 1997, agency staff, including a NMFS representative, met on site to review monitoring data from the previous year. A preliminary estimate was made that as much as 6 to 10 acres of riparian habitat might convert to brackish marsh if the dam was no longer operated (Iwamura, 1997 and Padley, 1997). Because of concerns about potential loss of valuable riparian forest habitat, several agencies stated that they would not approve of the elimination of Standish Dam unless the District compensated for any lost riparian forest at some ratio at another location.

5.2.5 1998 Agency Meeting

In 1998, Standish Dam was not installed, initially because of the sustained high flows in the creek due to a long and wet winter. The District was concerned that the earthen dam would wash out or cause other problems at these flow levels. CDFG agreed to delay installing the dam until flows were at a level that was not expected to result in overflow of the dam, and fish surveys showed no outmigrating steelhead juveniles present for several consecutive days.

In July of 1998, NMFS sent a letter to the Corps—San Francisco recommending that Standish Dam no longer be installed because of potential adverse impacts to steelhead and salmon. The Corps—San Francisco and CDFG subsequently sent letters directing the District to not install the dam in 1998. As a result, the District did not install Standish Dam in 1998 and organized a meeting on August 18, 1998, with agency personnel from Corps-San Francisco, NMFS, USFWS, USEPA, and CDFG to discuss future steps. At that meeting, all parties agreed that Standish Dam would not be installed in 1998, 1999, and 2000, and a monitoring program would be set up to provide information on the possible long-term effects of permanently removing the dam. This 3-year monitoring program (as described further below) focuses on tidal encroachment, streamflow, fish migration, spawning, thalweg elevations, groundwater, vegetative cover, and a photographic record.

The participants at the August 18, 1998, came to the conclusion that the installation of Standish Dam does not benefit salmonids. This conclusion was based on the results of annual surface water monitoring from 1990 to 1995 and 1997 (Stanley et al., 1991, 1992, and 1994; Jones & Stokes, 1996a and 1996b; and Salsbery, 1998). This monitoring found unsuitable conditions for salmonids were present in the freshwater impoundment upstream of Standish Dam in most summers due to a combination of high water temperatures in surface waters and suboptimal dissolved oxygen concentrations in the lower part of the water column. Through the years, there has been some discussion that temperatures in the stream may have been increased by removal of trees during construction of the flood control project and that eventually stream temperatures would lower as the mitigation sites planted for shade along the creek become established. However, in 1998, the District installed temperature loggers in Coyote Creek upstream of the flood control project and found that temperatures were at suboptimal levels before entering the flood control area.

Another concern expressed about Standish Dam at the August 18, 1998, meeting was that due to the seasonal timing of installation and operation, the dam appears to be a barrier to fish passage. In late spring, salmonid smolts may not be able to successfully migrate out of the stream once the dam is in place. In 1997 and 1998, steelhead smolts were captured moving downstream in Lower Coyote Creek during the months of May and June by District biologists and this smolt movement likely continues into the month of July if water temperatures remain sufficiently cool. In early fall, Chinook salmon have been observed downstream of Standish Dam blocked from migrating upstream. In 1996, during the removal of the earthen dam, Chinook salmon were observed swimming upstream immediately after the structure had been breached. One Chinook salmon carcass was observed washing upstream past the dam site in that year.

Although there was a general consensus at the August 18, 1998, meeting that Standish Dam had adverse effects on anadromous fish, there was not a consensus on the possible long-term effects of removing the dam on stream vegetation and whether this would be a beneficial or adverse effect. If the dam was no longer installed on the creek during the summer, it is expected that some of the riparian forest vegetation (primarily Fremont cottonwood and willows) would convert to brackish marsh vegetation (primarily bulrush and cattail). Because riparian forest is in such limited supply in south San Francisco Bay, some agency personnel were very concerned that permanent removal of Standish Dam could lead to a further reduction in this plant community. On the other hand, the District and other agency personnel consider the return of a naturally functioning system to the lower end of Coyote Creek to be a benefit to the natural environment. The 3-year monitoring program described further below is intended to provide additional information on the amount of vegetative change which might occur if Standish Dam was no longer installed.

5.3 MONITORING PROGRAM

As the design and operation of the dam changed, there have been several different monitoring programs. Originally, the focus was on determining the water quality conditions created in the ponded area during operation of the dam. By 1996, the monitoring shifted to an emphasis on tidal encroachment in the channel. Sampling of fish monitoring has occurred in several years. A summary of monitoring programs associated with Standish Dam is included in Table 20. Figure 7 shows the location of monitoring stations.

5.3.1 Ponded Water Quality Conditions

From 1990 through 1995, the water quality of the ponded area upstream of the dam was sampled to determine the quality of the fish habitat when the dam was in operation during the summer. This program also determined if any saltwater was trapped during dam installation so that remedial actions could be taken. Oxygen (milligrams per liter [mg/l]), temperature (degrees Celsius [°C]), depth of water (meters), and sometimes salinity (ppt), conductivity (micromhos per centimeter), and water clarity (Secchi depth in meters) were sampled vertically through the water column at 0.25 meter increments. Monitoring locations were Q2 through Q9, although the stations monitored each year and the actual locations of some stations varied somewhat between the years (see Table 20). Samples were taken in the morning and afternoon to determine diurnal patterns (1990 to 1995). Measurements were taken with YSI meters from a boat anchored as near the center of the stream channel as possible. If salinity was present in the ponded area after the dam had been installed, this sampling occurred every 3 days until the saline lens had dissipated (1990 to 1997). Otherwise, the sampling occurred once per month during operation of the dam.

In 1996, water quality sampling consisted only of measuring salinity, temperature, and depth immediately after the dam was installed.

In 1997, water quality monitoring was conducted after Standish Dam was installed to determine whether any saltwater had been trapped upstream of the dam. Profile measurements were taken at 0.25 meter increments vertically for temperature, specific conductance, conductivity, and salinity on May 12, 1997, and again on June 18, 1997, after the dam was reinstalled. Thereafter, the summer monitoring of the area upstream of the dam was limited to temperature. Temperature loggers were anchored in the stream at Q3, Q5, Q7, and Q8 at depths of 1 meter below the water surface and ¼ meter above the channel bottom. These loggers recorded temperature every hour. Some loggers were lost during an unexpected storm in late May. These were replaced June 18, 1997. Some loggers also experienced malfunctions.

No sampling of the ponded area occurred in 1998 since the dam was not installed in that year.

5.3.2 Tidal Conditions

In March, May, November, and December 1990 and November 1991, additional sampling for salinity (ppt and sometimes for conductivity at micromhos per centimeter), temperature (°C), and depth of water (meters) was undertaken while the dam was not in operation to determine the extent of tidal encroachment up the creek channel. This sampling occurred at five sites in 1990 and three sites in 1991 at 15-minute intervals for most of a high tide cycle.

From 1990 through 1992, Q1 and Q2 were sampled every 15 minutes through a high tide cycle at least 1 month during operation of the dam to determine tidal conditions downstream of the dam during the summer.

Based on the April 2, 1996, agency meeting and a requirement included in the 1996 CDFG Streambed Alteration Agreement for the seasonal installation of Standish Dam, another tidal encroachment monitoring program was developed. From October 1996 through March 1997, eight visits to fixed monitoring stations (Q3, Q6, Q8, Q9, Q10, and Q11) in Reaches 1 and 2 collected temperature, specific conductance (electrical conductivity), and salinity data to identify the extent to which tidal waters reached in Lower Coyote Creek (Leone, 1996). Sites Q10 and Q11 were new sites added for this tidal encroachment study. Monitoring was conducted from 1 to 2 hours before to 1 to 2 hours after daily higher high tide. Water quality data was collected at each station every 30 minutes. Streamflow was measured during the day of each field visit at approximately 50 yards downstream of the Old Alviso-Milpitas Road bridge at the upstream end of Reach 2. Tidal stage measurements were taken at the concrete foundation of the steel dam to the nearest 0.25 inch. Daily minimum and maximum air temperature and daily total rainfall were collected for the 3-day period prior to each field visit from the California Irrigation Management Information System.

This tidal encroachment study was conducted in the October 1996 through March 1997 period, since this was the only time when Standish Dam was out of the creek in that monitoring year. As this period is the rainy season in California, this monitoring data is not representative of the more extreme conditions which would occur in the creek during the summer dry season when freshwater flow is minimal and tidal water would be able to encroach further upstream.

In 1998, another tidal encroachment study was begun in response to the August 18, 1998, agency meeting. This program provides for measurement of salinity and temperature of surface water in Coyote Creek at six locations (Q1, Q2, Q3, Q7, Q8, and Q9) during the highest predicted daytime tide each month, May through October. These stations were originally established for a different purpose—to determine if suitable salinity and temperature conditions for anadromous fish were present when Standish Dam is operated. The Q-stations were reestablished in the field in 1999 and reevaluated to determine if substitute or additional sites were necessary to evaluate potential effects on riparian forest vegetation, particularly for the mitigation sites. CDFG approved the final selection of sites. Tides are estimated based on published tide tables predicting maximum tidal stage at Golden Gate Bridge in San Francisco. The field visits are scheduled to coincide with the highest predicted tides that occur during normal working hours with sufficient daylight to safely complete the sampling event. Reference is made to streamflow measurements simultaneously taken at the new U.S. Geological Survey real-time streamflow gage on Coyote Creek at Highway 237. However, since a rating curve has not been developed for that gage yet, streamflow measurements are taken at Highway 237 at the time of the salinity monitoring.

5.3.3 Fish Sampling

In August 1992 and 1993, fish were sampled with a 40-foot by 4-foot beach seine made of 3/16-inch mesh material and with multifilament and monofilament gill nets with mesh sizes ranging from ½ inch to 4 inches. Gill nets were set during the day in two 2-hour sets at Q3 and Q6. Beach seining was conducted at Q5.

In August 1994, two sets of gill nets were set for at least 2 hours at Q3, Q6, and Q9. The gill nets had mesh sizes of ½ inch to 2 inches and 2.5 inches to 4 inches. Q5 was sampled with a 50-foot by 6-foot beach seine with ¼-inch mesh.

In October 1995, fish were sampled using gill net, beach seine, and electrofisher sampling. Gill nets were approximately 50 feet long by 5 feet deep with variable ½-inch to 2-inch mesh openings and usually covered the entire water column from channel bottom to water surface. The beach seine was approximately 30 feet long by 4 feet deep with 3/16-inch mesh. The electrofisher was a Smith-Root model. Beach seining occurred at Q3, Q4, and Q5 in July and at Q4 and Q5 in August.

In 1996, fish were sampled in both July and August for a period of approximately 24 hours. Monafilament fill nets 125 feet long by 8 feet tall with varying mesh sizes (½ inch to 2 inches) were deployed at Q3, Q4, and Q6. Nets were anchored to the shore at one end and stretched across the channel at an angle so that the entire channel wide was nearly blocked by the net. Q3 and Q6 were sampled with floating gill nets, while Q4 was sampled using a sinking gill net. In July, a sinking gill net was set at Site Q2 parallel to the channel.

In 1996, downstream emigrant trapping was also added to the fish monitoring program. A framed net was placed in the thalweg of Coyote Creek approximately 200 feet downstream from Highway 237. This net was a fyke net configuration which collects and funnels downstream migrant fishes into a live car trap box. The trap was operated for 4 days per week, 24 hours each day, from May 13 to June 4, 1996. The trap live box was emptied every day in the morning and afternoon, and captured fish were identified and measured (Gilroy, 1998).

In the spring of 1997, smolt trapping was conducted again with a fyke net. The original trap was operated April 14 through 19, 1997, at a location 200 meters downstream of Highway 237. When construction of a bridge crossing near the Highway 237 started, this site was replaced with another site approximately 150 meters downstream of the Montague Expressway from April 23 through June 13, 1997. The mouth of the net was centered upstream in a shallow riffle run so that as much as 85 percent of the stream width/flow was sampled, including the thalweg where presumably the majority of the salmonid smolts would pass. The trap was set up and operated for 4 days and nights each week. The trap was checked twice each day, morning and afternoon. Species captured and numbers of each species were recorded along with ambient water and weather conditions at the time of trap check.

To determine the effectiveness of the trap, an experiment was conducted May 27 through 29, 1997. For this experiment, 44 steelhead/rainbow trout, a combination of young-of-year and smolts, were captured in Upper Penitencia Creek, a tributary to Coyote Creek, and transported to the trap site and placed in the live boxes. This experiment showed that the two experimental trap box configurations might not be sufficiently retaining small fish to adequately indicate the status of outmigrant salmonids in Coyote Creek.

At the August 18, 1998, agency meeting, an agreement was made regarding continued monitoring of the outmigration of fish. Outmigration of fish will be monitored in early spring using a fyke net (smolt trap) just downstream of Montague Expressway. The net is made of ¼-inch mesh, spread across the width of the streamflow, and connected to two in-line live car trap boxes. During the trapping operation, the trap will be visited daily usually around the 11 a.m. hour. Air and stream temperatures will be recorded every hour during the fish monitoring period with loggers. Fish or other wildlife in the trap box will be recorded by number and species. Field data will be recorded on field reporting forms. Any steelhead and salmon will be measured (fork length in millimeters), and fin clips and scales will be taken from a representative sample for genetic analysis and aging, respectively. Steelhead will be tagged with passive integrated transponders. An assessment will be made of the trapping effectiveness of the fyke net configuration.

Monitoring of outmigration of fish will be undertaken as early in the spring as flows subside sufficiently for the fyke net to operate (estimated to be late April), and continued until outmigration of steelhead smolts is no longer evident (estimated to be mid-June). In the event of a storm during the fish monitoring period, the fyke trap will be removed to prevent damage to fish and to the net. The net will be replaced as soon as possible after storm flows subside.

The August 18, 1998, agreement also included a provision for monitoring of spawning in Coyote Creek. Surveys in Lower Coyote Creek (from Highway 237 to Montague Expressway) will occur once monthly in October through April (unless there have been no storm events since the last inspection) to observe for migrating adult salmon and steelhead, locate any spawning activity and redds, and determine if spawning gravels are being utilized.

5.3.4 Other Monitoring Associated With Three-Year Experiment

The August 18, 1998, agency meeting also included monitoring of several other indicators at Coyote Creek to assist in predicting the long-term changes which may occur in the creek if the dam is no longer operated. The thalweg (line connecting the lowest or deepest points along a streambed) will be surveyed with an emphasis on measuring the water depth at the salinity monitoring locations and any locations where there is a noticeable drop in channel depth.

Eighteen shallow groundwater wells (W6 and W9 to W25) will be monitored on a monthly basis from April to October and every other month during the remainder of the year. Depth to groundwater in tenths of feet and salinity (conductivity in microSiemens/centimeters) will be measured.

The amount of vegetative cover along the creek will be measured up to the location of Q9 (approximate location of downstream end of pilot revegetation site) on an annul basis. Cover will be measured using a representative sampling method with line transects in a manner similar to that undertaken along this section of Coyote Creek in previous years.

The District has requested that the agencies consider changing the vegetation monitoring method to one that utilizes aerial photography. We believe that transect-based cover monitoring will not show gradual changes in creek vegetation for several years. We propose that this method be replaced with the use of annual aerial photographs which would be flown in late summer. The aerials would be checked in the field to confirm the extent and condition of creek vegetation, and then converted to a Geographic Information System format to measure total cover of riparian forest and brackish marsh vegetation. Annual data will be compared to data collected from pre-1998 aerials to estimate the amount and location of vegetative change along the creek.

Photographic monitoring points will be established along Lower Coyote Creek. These points will be located at the salinity monitoring points, upstream and downstream of the crossover sites, and at any revegetation sites which are not represented by other photographic monitoring points. At each monitoring point, photographs will be taken from each bank looking towards the creek. At the salinity monitoring points and the crossover sites, photographs will also be taken from the creek looking upstream and downstream.

An annual report will be submitted in June of 1999 and January of 2000 and 2001 to the agencies. The annual report will summarize the monitoring data from the previous year. The year 2001 report will utilize the 3-year record to evaluate the potential conversion of creek vegetation if Standish Dam is no longer operated.

5.4 MONITORING RESULTS

5.4.1 Ponded Water Quality Conditions

Water quality in the ponded area upstream of Standish Dam was monitored to determine its suitability for summer rearing habitat for steelhead. For steelhead trout, optimal temperatures are below 18°C. Suboptimal temperatures occur between 18°C to 24°C. Steelhead trout can survive in suboptimal temperatures provided that other factors such as food availability and water quality are satisfactory. Temperatures above 25°C are considered lethal under most environmental conditions if they persist for more than a few hours. Dissolved oxygen (DO) concentrations above 5.0 mg/l are considered optimal for steelhead trout. DO concentrations falling below 5.0 mg/l are considered suboptimal. As with temperature, steelhead trout can survive in suboptimal DO concentrations provided other factors are satisfactory. Persistent DO concentrations less than 2.0 to 3.0 mg/l are considered lethal.

In 1995, a comparison was made between the water quality data collected in the ponded area upstream of the dam each summer from 1990 through 1995 (Jones & Stokes 1996a). In 1995, the range of maximum daily temperatures in the top meter of the water column at all sites during the months of July, August, and September was 21.0 to 25.5°C (suboptimal to lethal for steelhead). Previous years had a similar range of values, except for 1993 and 1994, which were higher by 1.0 to 2.0°C. During July, August, and September 1995, a layer of water with dissolved oxygen levels less than 5.0 mg/l (suboptimal for steelhead) ranged from 0.75 to 1.5 meters above the bottom, and similar values occurred in 1990, 1991, and 1994. In 1992, the anaerobic layer was most intense, ranging in thickness from 0.85 to 2.0 meters.

During every summer from 1991 to 1995, unsuitable conditions for steelhead (lethal temperatures and suboptimal or lethal DO concentrations) were present during at least one monthly sampling event. In 1990, surface water conditions never exceeded lethal thresholds as they did in subsequent years through 1995. The combination of high water temperature in the surface waters and suboptimal DO concentrations in the lower part of the water column indicate that the seasonal lake provides marginal conditions for steelhead trout during the summer months.

In 1997, water temperatures generally ranged approximately 20°C to 23°C from June 18 to October 7, 1997, indicating possible suboptimal conditions for steelhead trout at sometime during the summer. No DO concentrations were monitored in 1997.

5.4.2 Tidal Sampling

In 1990, monitoring of salinity during winter tides showed no salinity influence at Q8 in March, but some signs of salinity changes at this site during high tides in November and December. Salinity change was also observed at Q8 during the November 1991 winter tidal cycle salinity monitoring.

The farthest upstream extent of salinity during the fall/winter 1996/97 monitoring was midway between monitoring sites Q9 and Q10, alongside the pilot revegetation site. Tidal salinity was not present upstream of Dixon Landing Road during many of the monitoring events. The results of the 1996/97 tidal encroachment study indicated the time lag between the maximum tidal stage at Golden Gate Bridge in San Francisco and maximum tidal stage at Lower Coyote Creek was usually 1.75 hours but on one occasion was 2.25 hours.

On October 22, 1998, salinity and water temperature measurements were recorded at five locations. This day was selected for sampling due to the relatively high tide, which corrected for south bay, was 8.8 feet at 14:16. The locations monitored in 1998 (T3, T6, T8, T9, and T11) do not directly correspond to the former monitoring locations for temperature and dissolved oxygen (Q3, Q6, Q8, Q9, and Q11). The 1998 field crew was unable to relocate the Q sampling stations and was blocked from progressing upstream towards Q11 by a downed tree. The T sites were selected in the field because they either appeared to correspond with the Q sites, or otherwise exhibited conditions that might be valuable for salinity monitoring (i.e., they were close to revegetation sites that might be affected by salinity changes). Sites T6 and T8 correlate somewhat to Q7 and Q9, respectively. Site T3 is adjacent to Riparian Site 1-1, Site T6 is upstream of the delta channels, Site T8 is upstream of Riparian Site 4-1, and Sites T8 and T9 are adjacent to Riparian Site 5-4.

Prior to the high tide, all sites began with a salinity of 0.7 to 0.8 ppt. Sites T3 and T6 showed effects of the tide with salinities rising from this level to 3.7 ppt and 3.5 ppt, respectively, in a 2-hour period. Somewhat elevated salinity levels were still present at these two sites 2 hours later. Monitoring was not conducted long enough to determine how long it was before salinity levels went back to the 0.7 ppt range. Salinity did not increase at Sites T8, T9, and T11 during the monitoring period, although sites T8 and T9 did show an increase in water depth of ¼ to ½ meter due to the tidal influence.

5.4.3 Fish Sampling

No steelhead trout were collected on Lower Coyote Creek during summer fish monitoring efforts from 1992 through 1996. Only warmwater species were captured. Along with the summer ponded water quality measurements, this seems to indicate that Standish Dam does not create conditions suitable for summer rearing of salmonids.

However, fyke net monitoring of outmigrating fish in the spring of 1997 and 1998 indicates that the Lower Coyote Creek system does provide a migratory corridor for steelhead.

In 1997, 21 species of fish were captured in the fyke net along with bullfrog, crayfish, mitten crab, and fresh water clam. Sacramento sucker was the fish most frequently caught. Two steelhead/rainbow trout young-of-year were captured on June 6 and 12, 1997; however, these may have been captured as a result of an experiment to test the effectiveness of the trap and may not have been fish that would have otherwise been found in the creek.

Smolt trapping was conducted for 13 days from May to mid-June 1998 with a fyke net in a similar manner to 1997. Typically, 40 to 65 percent of the stream was being fished while the fyke net was in place. The fyke net was removed for several days on May 7 and June 12 because of storm events. Twenty-one species of fish (including Pacific lamprey) were captured along with bullfrog, Louisiana red crayfish, Chinese mitten crab, and a few other nonfish species. A total of 15 steelhead smolts were captured. Fourteen of these were captured between May 8 and May 11, and one on May 24.

5.4.4 Vegetation Monitoring

Vegetation monitoring occurred at four sites in 1998 from the island (Site 1-1) at the downstream end to the pilot revegetation site (Riparian Site 5-4) at the upstream end. Absolute overstory cover was 34 percent at the island, 82 percent at Riparian Site 4-2, 66 percent at Riparian Site 4-3, and 58 percent at the pilot revegetation site (Table 21). Tables 21 and 22 compare tree cover at the four sites for 1994 and 1996 before Standish Dam was experimentally not installed during the summer and in 1998 in the first year of not installing the dam. The island, Site 1-1, shows a slight decrease in tree cover from 26 percent in 1996 to 24 percent in 1998. Site 4-3 also showed a decrease from 72 percent tree cover in 1996 to 64 percent in 1998. The other two sites showed an increase in tree cover over this 2-year period. There were no visual signs of vegetation damage from salinity such as browning of leaf tips.

The thalweg, groundwater, and photomonitoring results will be reported in the next monitoring report.

5.5 PROPOSED MANAGEMENT MEASURES FOR STANDISH DAM

- Standish Dam should not be installed through the year 2000, and the monitoring program agreed to at the August 18, 1998, agency meeting should be continued.
- With approval of the agencies, aerial photography should replace the transect-based method for vegetation monitoring associated with Standish Dam. It is expected that aerial based monitoring with groundtruthing will more quickly show trends of vegetation change.
- An earthen dam has been left across the side channel of the creek to allow continued access to Riparian Site 1-1 during establishment of its vegetation. The original intention was to remove this dam once the vegetation had established, so the site would be an island with one side suitable for bird nesting. However, we recommend that this earthen dam across the side channel remain in place during the 3-year monitoring period for Standish Dam to allow continued access to the groundwater monitoring wells at this site.

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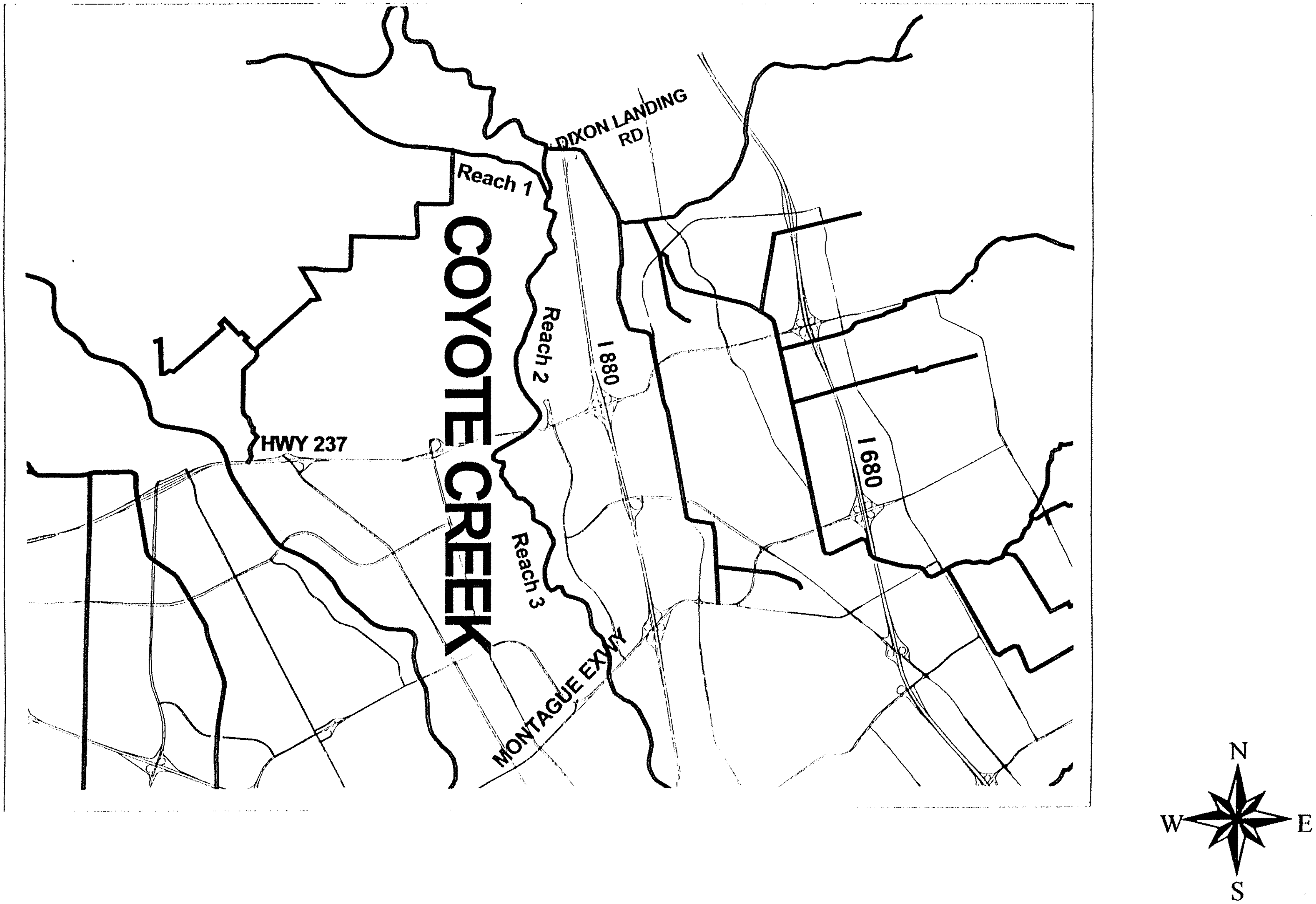
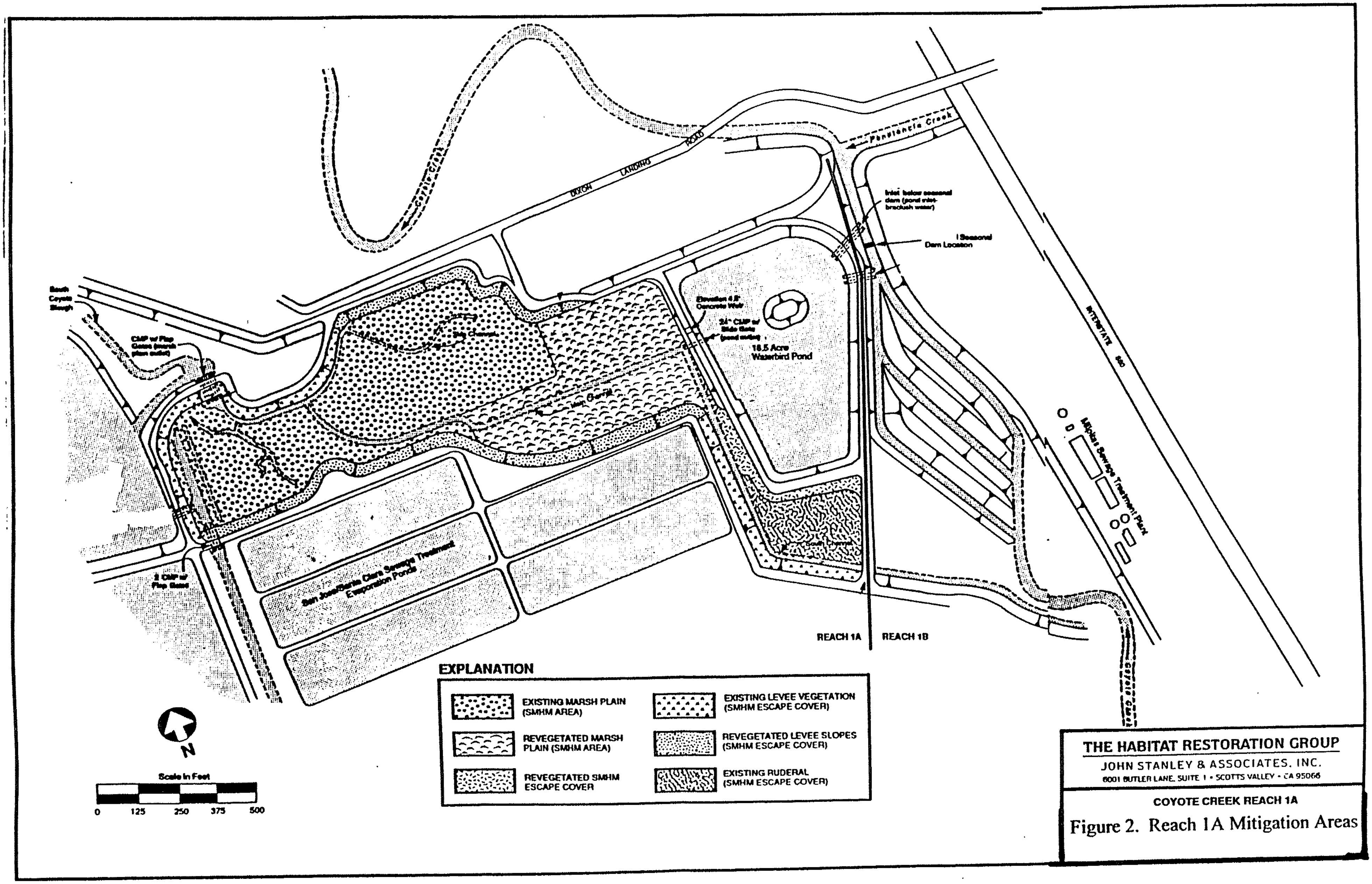
FIGURES

Figure 1. Location Map,
Lower Coyote Creek Flood Control Project




Coyote Creek
Dixon Landing Road
Penitencia Creek
Inlet below seasonal dam (pond inlet-brackish water)
1 Seasonal Dam Location
Interstate 880
Milpitas Sewage Treatment Plant
Elevation 4.5' Concrete Weir
24" CMP w/ Slide Gate (pond outlet)
18.5 Acre Waterbird Pond
South Coyote Slough
CMP w/ Flap Gates (marsh plain outlet)
2 CMP w/ Flap Gates
San Jose/Santa Clara Sewage Treatment Evaporation Ponds
REACH 1A
REACH 1B
EXPLANATION
EXISTING MARSH PLAIN (SMHM AREA)
REVEGETATED MARSH PLAIN (SMHM AREA)
REVEGETATED SMHM ESCAPE COVER
EXISTING LEVEE VEGETATION (SMHM ESCAPE COVER)
REVEGETATED LEVEE SLOPES (SMHM ESCAPE COVER)
EXISTING RUDERAL (SMHM ESCAPE COVER)
N
Scale in Feet
0
125
250
375
500

THE HABITAT RESTORATION GROUP
JOHN STANLEY & ASSOCIATES, INC.
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COYOTE CREEK REACH 1A

Figure 2. Reach 1A Mitigation Areas

TABLES

TABLE 1
Scientific Names for Plant and Animal Species

Common Name—Plants	Scientific Name—Plants
Box elder	*Acer negundo* var. *californicum*
California buckeye	*Aesculus californica*
California sage	*Artemisia californica*
Mugwort	*Artemisia douglasiana*
Giant reed	*Arundo donax*
Western aster	*Aster chilensis*
Saltbush	*Atriplex lentiformis* ssp. *lentiformis*
Marsh baccharis	*Baccharis douglasii*
Coyote brush	*Baccharis pilularis*
Mule fat	*Baccharis salicifolia*
Virgin's bower	*Clematis ligusticifolia*
Western goldenrod	*Euthamia occidentalis*
Alkali heath	*Frankenia salina*
Oregon ash	*Fraxinus latifolia*
Wild licorice	*Glycoyrrhiza lepidota*
Leatheroot	*Hoita macrostachya*
Northern California black walnut	*Juglans californica* var. *hindsii*
Perennial peppergrass	*Lepidium latifolium*
Beardless wildrye	*Leymus triticoides*
Tree tobacco	*Nicotiana glauca*
Western sycamore	*Platanus racemosa*
Fremont cottonwood	*Populus fremontii*
Coast live oak	*Quercus agrifolia*
Valley oak	*Quercus lobata*
California coffeeberry	*Rhamnus californica*
California rose	*Rosa californica*
California blackberry	*Rubus ursinus*
Pickleweed	*Salicornia virginica*
Weeping willow	*Salix babylonica*
Narrow-leaved willow	*Salix exigua*
Red willow	*Salix laevigata*
Arroyo willow	*Salix lasiolepis*
Willows	*Salix* sp.
Blue elderberry	*Sambucus mexicana*
Alkali bulrush	*Scirpus robustus*
Bulrush	*Scirpus* sp.
Redwood	*Sequoia sempervirens*
Snowberry	*Symphocarpos albus* var. *laevigatus*
Cattail	*Typha* sp.
Elm	*Ulmus americana*
California bay	*Umbellularia californica*

TABLE 1
Scientific Names for Plant and Animal Species
(continued)

Common Name—Mammals	**Scientific Name—Mammals**
Black-tailed Jackrabbit	*Lepus californicus*
California Ground Squirrel	*Spermophilus beecheyi*
California Meadow Mouse	*Microtus californicus*
Deer Mouse	*Peromyscus maniculatus*
Desert Cottontail Rabbit	*Sylvilagus audubonii*
Dusky-footed Woodrat	*Neotoma fuscipes*
House Mouse	*Mus musculus*
Raccoon	*Procyon lotor*
Red Fox	*Vulpes vulpes*
Salt Marsh Harvest Mouse	*Reithrodontomys raviventris*
Western Harvest Mouse	*Reithrodontomys megalotis*
Shrew	*Sorex* sp.
Common Name—Birds	**Scientific Name—Birds**
American Goldfinch	*Carduelis tristis*
American Avocet	*Recurvirostra americana*
Black-necked Stilt	*Mimantopus mexicanus*
Brown-headed Cowbird	*Molothrus ater*
California Gull	*Larus californicus*
Chestnut-backed Chickadee	*Parus rufescens*
Common Bushtit	*Psaltriparus minimus*
Common Yellowthroat	*Geothlypis trichas*
Dowitcher	*Limnodromus* sp.
Fox Sparrow	*Passerella iliaca*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Hermit Thrush	*Dendroica occidentalis*
House Finch	*Carpodacus mexicanus*
Northern Shoveler	*Anas clypeata*
Song Sparrow	*Melospiza melodia*
Western Flycatcher	*Empidonax difficilis*
Western Sandpiper	*Calidris mauri*
White-crowned Sparrow	*Zonotrichia leucophrys*
Yellow Warbler	*Dendroica aestiva*
Common Name—Fish	**Scientific Name—Fish**
Chinook Salmon	*Onchorhunchus tschawytscha*
Pacific lamprey	*Lampetra tridentata*
Rainbow Trout/Steelhead	*Onchorhynchus mykiss*
Sacramento Sucker	*Catostomus occidentalis*

TABLE 1
Scientific Names for Plant and Animal Species
(continued)

Common Name—Reptiles	**Scientific Name—Reptiles**
Coast Garter Snake	*Thamnophis elegans*
Gopher Snake	*Pitouphis melanoleucus*
Northern Alligator Lizard	*Gerrhonotus coeruleus*
Racer	*Coluber constrictor*
Southern Alligator Lizard	*Gerrhonotus multicarinatus*
Southwestern Pond Turtle	*Clemmys marmorata pallida*
Western Fence Lizard	*Sceloporus occidentalis*
Common Name—Amphibians	**Scientific Name—Amphibians**
Bullfrog	*Rana catesbeiana*
Pacific Tree Frog	*Hyla regilla*

Table 12. Absolute Percent Cover
Riparian Forest Site 6-1, Lower Coyote Creek

	1996 (Year 3)	
Cover Type	Understory	Overstory
Artemisia douglasiana	6	0
Aster chilensis	3	0
Baccharis douglasii	2	0
Euthamia occidentalis	5	0
Glycoyrrhiza lepidota	0	0
Hoita macrostachya	0	0
Leymus triticoides	2	0
TOTAL TARGET HERB	**17**	**0**
Acer negundo var. *californicum*	0	2
Fraxinus latifolia	0	0
Juglans californica var. *hindsii*	0	0
Platanus racemosa	0	1
Populus fremontii	0	1
Quercus agrifolia	0	1
Quercus lobata	0	0
Salix babylonica	0	0
Salix exigua	0	0
Salix sp.	0	8
Sambucus mexicana	1	3
Sequoia sempervirens	0	1
Umbellularia californica	0	0
Ulmus americana	0	0
TOTAL TREE	**2**	**17**
Artemisia californica	0	0
Atriplex lentiformis ssp. *lentiformis*	0	0
Baccharis pilularis	23	4
Baccharis salicifolia	2	0
Clematis ligusticifolia	0	0
Nicotiana glauca	0	0
Rhamnus californica	0	0
Rosa californica	1	0
Rubus ursinus	6	0
Symphocarpos albus var. *laevigatus*	0	0
TOTAL SHRUB	**33**	**5**
Arundo donax	0	0
HERB	39	0
TOTAL NONTARGET HERB	**39**	**0**
LITTER	18	0
SNAG	0	1
BARE/NONE	2	77
OTHER	0	1
TOTAL	110	101
TOTAL % COVER	**59**	**23**

Table 13. Percent Survival By Sites, Years 1 and 2, Reach 3 Lower Coyote Creek

Cover Type	R-1		R-2		R-3A		R-3B&C		R-4A		R-4B	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
HERBACEOUS												
Artemisia douglasiana	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%	96%
Aster chilensis	100%	100%	100%	100%	87%	80%	94%	100%	92%	94%	100%	96%
Baccharis douglasii	100%	100%	100%	100%	83%	83%	100%	100%	100%	100%	100%	100%
Euthamia occidentalis	100%	100%	100%	100%	100%	100%	96%	100%	97%	99%	100%	100%
Leymus triticoides	100%	90%	96%	94%	82%	82%	96%	100%	94%	77%	100%	86%
TREE												
Acer negundo var. *californicum*	99%	99%	97%	100%	100%	100%	94%	96%	92%	91%	99%	100%
Aesculus californica	100%	100%	88%	88%	78%	78%	89%	83%	72%	71%	90%	90%
Platanus racemosa	99%	96%	94%	95%	98%	98%	100%	96%	94%	92%	94%	86%
Populus fremontii	100%	100%	98%	95%	96%	95%	91%	93%	98%	98%	95%	95%
Quercus agrifolia	100%	92%	79%	85%	92%	89%	93%	93%	97%	95%	96%	100%
Quercus lobata	98%	98%	90%	90%	88%	91%	93%	89%	97%	93%	95%	92%
Salix laevigata	96%	96%	98%	94%	85%	80%	86%	86%	98%	87%	93%	88%
Salix lasiolepis	98%	98%	94%	96%	88%	90%	92%	95%	97%	97%	94%	94%
Sambucus mexicana	72%	55%	60%	67%	62%	61%	80%	77%	52%	46%	38%	35%
SHRUB												
Artemisia californica	100%	75%	71%	71%	100%	100%	60%	100%	86%	75%	77%	69%
Baccharis pilularis	100%	100%	92%	92%	94%	94%	78%	94%	96%	94%	98%	100%
Baccharis salicifolia	100%	100%	100%	100%	100%	93%	100%	100%	96%	88%	100%	100%
Clematis ligusticifolia	94%	50%	78%	59%	83%	89%	38%	32%	58%	64%	77%	90%
Rosa californica	100%	100%	100%	98%	100%	100%	90%	72%	97%	97%	98%	98%
Rubus ursinus	93%	89%	81%	62%	77%	57%	67%	52%	90%	96%	96%	96%
Symphocarpos albus var. *laevigatus*	100%	100%	100%	92%	94%	94%	100%	100%	100%	92%	100%	90%

Table 13. Percent Survival By Sites, Years 1 and 2, Reach 3 Lower Coyote Creek

Cover Type	R-5		R-6		S-1		S-2		S-3*		S-4*	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
HERBACEOUS												
Artemisia douglasiana	100%	100%	90%	100%	100%	100%	100%	100%				
Aster chilensis	100%	100%	100%	100%	100%	100%	100%	80%				
Baccharis douglasii	100%	100%	100%	100%	100%	100%	100%	100%				
Euthamia occidentalis	92%	92%	93%	86%	100%	100%	100%	100%				
Leymus triticoides	100%	94%	98%	88%	100%	100%	90%	90%				
TREE												
Acer negundo var. *californicum*	98%	94%	95%	93%	99%	100%	100%	100%	80%	80%	100%	100%
Aesculus californica	78%	67%	50%	94%	93%	93%	100%	100%				
Platanus racemosa	96%	90%	93%	97%	98%	95%	100%	100%	91%	82%	100%	60%
Populus fremontii	95%	94%	100%	97%	94%	92%	98%	98%	100%	100%	54%	23%
Quercus agrifolia	99%	87%	100%	91%	93%	90%	90%	70%	100%	100%	100%	67%
Quercus lobata	95%	89%	97%	94%	100%	96%	100%	100%	80%	100%	100%	67%
Salix laevigata	94%	80%	95%	83%	89%	76%	96%	56%	57%	43%	40%	25%
Salix lasiolepis	94%	90%	97%	98%	97%	96%	94%	83%	32%	14%	50%	45%
Sambucus mexicana	49%	45%	76%	76%	78%	78%	92%	92%				
SHRUB												
Artemisia californica	78%	56%	80%	80%	100%	100%	100%	100%				
Baccharis pilularis	100%	100%	90%	90%	93%	93%	100%	100%				
Baccharis salicifolia	99%	99%	94%	94%	93%	93%	100%	100%				
Clematis ligusticifolia	83%	59%	85%	72%	72%	42%	89%	100%				
Rosa californica	99%	99%	100%	100%	100%	100%	100%	100%				
Rubus ursinus	94%	93%	88%	48%	90%	83%	100%	92%				
Symphocarpos albus var. *laevigatus*	100%	89%	95%	90%	100%	78%	100%	100%				

*For S-3 and S-4, willows were planted as cuttings; other installed as containers.

Table 14. Survival Rate of Installed Plants
Riparian Revegetation Sites
Lower Coyote Creek, Reach 3
1998 (Year 2)

Planting Area	Survival of Installed Plants
Riparian Forest Sites	
R-1	93%
R-2	90%
R-3A	88%
R-3BC	87%
R-4A	89%
R-4B	91%
R-5	88%
R-6	90%
Aquatic Shade Sites	
S-1	89%
S-2	91%
S-3, S-4 container plants	78%
S-3, S-4 cuttings	31%

Table 15. Overall Survivorship by Species
All Reach 3 Riparian Areas (R1-R6 and S1-S2)
Lower Coyote Creek

Tree Species	
Box elder	95%
California buckeye	79%
Western sycamore	92%
Fremont cottonwood	96%
Coast live oak	92%
Valley oak	92%
Red willow	85%
Arroyo willow	94%
Blue elderberry	53%
Tree subtotal	86%
Shrub and Vine Species	
California sage	74%
Coyote brush	96%
Mulefat	96%
Virgin's bower	63%
California blackberry	84%
California rose	96%
Snowberry	92%
Shrub/Vine subtotal	86%
Herbaceous Species	
Mugwort	99%
Western aster	97%
Marsh baccharis	99%
Western goldenrod	97%
Beardless wildrye	88%
Herbaceous subtotal	96%
GRAND TOTAL	89%
Source:	
Sierra View Landscape, Inc. 1999.	

Table 16. Bird Monitoring Data, Lower Coyote Creek

1994-95	**Observations**	**Species**	**Shannon-Weaver diversity indices**	**Most Common Observed Species**	**Guilds** By Species
Riparian point counts	1103	45	3.11	House Finch, Song Sparrow, Common Bushtit	36% FOLGL 27% GROGL
Pilot point counts (Year 8)	1014	37	3.02	American Goldfinch, Song Sparrow, House Finch	43% FOLGL 30% GROGL
Riparian mist nets	578	43	3.07	Hermit Thrush, Western Flycatcher, Fox Sparrow	53% FOLGL 26% GROGL
Pilot mist nets (Year 8)	1152	59	3.19	Song Sparrow, Western Flycatcher, House Finch	46% FOLGL 25% GROGL

1995-96	**Observations**	**Species**	**Shannon-Weaver diversity indices**	**Most Common Observed Species**	**Guilds** By Species
Riparian point counts	1036	42	1.29	House Finch, Common Bushtit, Song Sparrow	32% FOLGL 34% GROGL
Pilot point counts (Year 9)	881	41	1.24	House Finch, Song Sparrow	38% FOLGL 32% GROGL
Riparian mist nets	480 or 0.20 birds per net hour	41	1.32	Hermit Thrush, Western Flycatcher, Song Sparrow	42% FOLGL 33% GROGL
Pilot mist nets (Year 9)	1235 or 0.45 bird per net hour	48	1.30	House Finch, Song Sparrow, Western Flycatcher	41% FOLGL 38% GROGL

Table 16 continued, Bird Monitoring Data, Lower Coyote Creek

1996-97	Observations	Species	Shannon-Weaver diversity indices	Most Common Observed Species	Guilds By Species
Riparian point counts	1006	59	1.40	House Finch, Song Sparrow, Yellow-rumped warbler	36% FOLGL 32% GROGL
Pilot point counts (Year 10)	900	53	1.36	Song Sparrow, Yellow-rumped warbler, House Finch	29% FOLGL 32% GROGL
Riparian Site 6-1 point counts (Year 3)	1149	51	1.32	House Finch, Song Sparrow	33% FOLGL 32% GROGL
Riparian mist nets	651 or 0.27 birds per net hour	43	1.35	Hermit Thrush, Western Flycatcher	46% FOLGL 30% GROGL
Pilot mist nets (Year 10)	952 or 0.39 birds per net hour	45	1.35	Western Flycatcher, Song Sparrow, Hermit Thrush	56% FOLGL 27% GROGL
Riparian Site 6-1 mist nets (Year 3)	2047 or 0.84 birds per net hour	53	1.34	House Finch, White-crowned Sparrow	42% FOLGL 32% GROGL

Mist net data were standardized for some years by amount of time spent surveying.
FOLGL – Foliage Gleaning – picking up items from the surface of soil, turf, sand, etc. Includes scavenging dead aquatic organisms from shoreline.
GROGL – Ground Gleaning – gleaning from foliage and occasionally from branches. Takes invertebrates and/or fruit from vegetation, not from the surface of the ground.
Avian guild codes from Ehrlich et al. 1988.

Table 17. Number of Breeding Bird Species Detected, Reach 2, Coyote Creek

1994-95	23	Most abundant were Song Sparrows, Brown-headed Cowbird, and Common Yellowthroat.
1995-96	21	Most abundant were Song Sparrows, Brown-headed Cowbird, and American Goldfinch.
1996-97	28	Most abundant were Song Sparrow, Common Bushtit, Common Yellowthroat

Table 18. Mammal species captured at Coyote Creek Reach 2 in 1996

Date	Species	Common Name	No.	No. Adults	No. Juvenile	How Determined
6/26/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured/keyed
6/26/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured/keyed
6/26/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured/keyed
6/27/1996	Reithrodontomys megalotis	Western Harvest Mouse	2			captured
6/27/1996	Reithrodontomys megalotis	Western Harvest Mouse	3			captured
6/27/1996	Sorex sp.	Shrew	1			captured
6/28/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
6/28/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
6/28/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
6/30/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
7/1/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
7/1/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
7/1/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
7/1/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
7/1/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
7/2/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
7/2/1996	Reithrodontomys megalotis	Western Harvest Mouse	2			captured
7/3/1996	Reithrodontomys megalotis	Western Harvest Mouse	2			captured
7/4/1996	Reithrodontomys megalotis	Western Harvest Mouse	1			captured
8/17/1996	Mus musculus	House Mouse	1	0	1	captured/keyed
9/16/1996	Mus musculus	House Mouse	6	3	3	captured/keyed
9/16/1996	Neotoma fuscipes	Dusky-footed Woodrat	1			captured
9/16/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	0	1	captured/keyed
9/16/1996	Reithrodontomys megalotis	Western Harvest Mouse	2	0	2	captured/keyed
9/17/1996	Mus musculus	House Mouse	1	1	0	captured/keyed
9/17/1996	Mus musculus	House Mouse	7	2	5	captured/keyed
9/17/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	1	0	captured/keyed
9/17/1996	Reithrodontomys megalotis	Western Harvest Mouse	2	1	1	captured/keyed
9/18/1996	Microtus californicus	California Vole	1	1	0	captured/keyed
9/18/1996	Mus musculus	House Mouse	1	1	0	captured/keyed
9/18/1996	Mus musculus	House Mouse	2	2		captured/keyed
9/18/1996	Mus musculus	House Mouse	2	1	1	captured/keyed
9/18/1996	Mus musculus	House Mouse	6	3	3	captured/keyed
9/18/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	1	0	captured/keyed
9/19/1996	Microtus californicus	California Vole	1	1	0	captured/keyed
9/19/1996	Mus musculus	House Mouse	2	2	0	captured/keyed
9/19/1996	Mus musculus	House Mouse	4	2	2	captured/keyed
9/19/1996	Neotoma fuscipes	Dusky-footed Woodrat	1	1	0	captured
9/19/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	0	1	captured/keyed
9/19/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	0	1	captured/keyed
9/19/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	1	0	captured/keyed
9/20/1996	Microtus californicus	California Vole	2			captured/keyed
9/20/1996	Mus musculus	House Mouse	1	1	0	captured/keyed
9/20/1996	Mus musculus	House Mouse	2			captured/keyed
9/20/1996	Mus musculus	House Mouse	2			captured/keyed
9/20/1996	Mus musculus	House Mouse	5	1		captured/keyed
9/20/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	1	0	captured/keyed
9/20/1996	Reithrodontomys megalotis	Western Harvest Mouse	2	0	2	captured/keyed
11/20/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	0	1	captured/keyed
11/21/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	0	1	captured/keyed
11/21/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	0	1	captured/keyed
11/22/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	0	1	captured/keyed
11/23/1996	Reithrodontomys megalotis	Western Harvest Mouse	1	1	0	captured/keyed
11/26/1996	Microtus californicus	California Vole	1	0	1	captured/keyed

Table 18. Mammal species captured at Coyote Creek Reach 2 in 1997.

Date	Species	Common Name	No.	No. Adults	No. Juvenile	How Determined
4/29/1997	Rattus rattus	Black Rat	2	2		captured/keyed
4/29/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
4/29/1997	Reithrodontomys megalotis	Western Harvest Mouse	1			captured/keyed
4/29/1997	Reithrodontomys megalotis	Western Harvest Mouse	2	2		captured/keyed
4/29/1997	Reithrodontomys megalotis	Western Harvest Mouse	3	3		captured/keyed
4/29/1997	Sorex sp.	Shrew	1	1		captured/keyed
4/30/1997	Rattus rattus	Black Rat	4		4	captured/keyed
4/30/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
4/30/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
4/30/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
4/30/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
4/30/1997	Reithrodontomys megalotis	Western Harvest Mouse	3	3		captured/keyed
5/1/1997	Rattus rattus	Black Rat	4	1		captured/keyed
5/1/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
5/1/1997	Reithrodontomys megalotis	Western Harvest Mouse	2	2		captured/keyed
5/1/1997	Reithrodontomys megalotis	Western Harvest Mouse	2	2		captured/keyed
5/1/1997	Reithrodontomys megalotis	Western Harvest Mouse	2	2		captured/keyed
5/2/1997	Rattus rattus	Black Rat	2		2	captured/keyed
5/2/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
5/2/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
5/2/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
5/2/1997	Sorex sp.	Shrew	1	1		captured/keyed
5/3/1997	Rattus rattus	Black Rat	2			captured/keyed
5/3/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
5/3/1997	Reithrodontomys megalotis	Western Harvest Mouse	1	1		captured/keyed
5/3/1997	Reithrodontomys megalotis	Western Harvest Mouse	2	2		captured/keyed
5/7/1997	Rattus rattus	Black Rat	1	1		captured/keyed
5/7/1997	Rattus rattus	Black Rat	1	0	1	captured/keyed

Table 19. Reptile species captured or observed at Coyote Creek Reach 2 in 1996

Date	Species	Common Name	No.	No. Adults	No. Juveniles	How Determined
6/26/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1			captured/keyed
6/27/1996	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
6/27/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1			captured/keyed
6/28/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1			capture/keyed
6/29/1996	Gerrhonotus coeruleus	Northern Alligator Lizard	1	1		captured/keyed
6/29/1996	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
6/29/1996	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
6/29/1996	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
6/29/1996	Gerrhonotus multicarinatus	Southern Alligator Lizard	2	2		captured/keyed
6/29/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1			captured/keyed
6/29/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1			captured/keyed
6/29/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
6/29/1996	Sceloporus occidentalis	Northwestern Fence Lizard	4	4		captured/keyed
6/30/1996	Sceloporus occidentalis	Northwestern Fence Lizard	2	2		captured/keyed
6/30/1996	Sceloporus occidentalis	Northwestern Fence Lizard	2	2		captured/keyed
6/30/1996	Thamnophis elegans	Coast Garter Snake	1	1		captured/keyed
7/1/1996	Gerrhonotus coeruleus	Northern Alligator Lizard	1	1		captured/keyed
7/1/1996	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
7/1/1996	Pitouphis melanoleucus	Gopher Snake	1			captured/keyed
7/1/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
7/1/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
7/1/1996	Sceloporus occidentalis	Northwestern Fence Lizard	2			captured/keyed
7/2/1996	Gerrhonotus multicarinatus	Southern Alligator Lizard	1			captured/keyed
7/2/1996	Pitouphis melanoleucus	Gopher Snake	1			captured/keyed
7/2/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
7/2/1996	Sceloporus occidentalis	Northwestern Fence Lizard	2	2		captured/keyed
7/2/1996	Sceloporus occidentalis	Northwestern Fence Lizard	2	2		captured/keyed
7/2/1996	Sceloporus occidentalis	Northwestern Fence Lizard	3	3		captured/keyed
7/3/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
7/3/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
7/4/1996	Pitouphis melanoleucus	Gopher Snake	1			captured/keyed
7/4/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
7/4/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
7/4/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
7/4/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
10/24/1996	Coluber constrictor	Racer	1		1	observed
11/19/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed(fo
11/19/1996	Sceloporus occidentalis	Northwestern Fence Lizard	2	2		captured/keyed(fo
11/21/1996	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	0	1	captured/keyed
11/25/1996	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
11/26/1996	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed

Table 19. Reptile species captured or observed at Coyote Creek Reach 2 in 1997

Date	Species	Common Name	No.	No. Adults	No. Juveniles	How Determined
4/29/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
4/29/1997	Sceloporus occidentalis	Northwestern Fence Lizard	2	1	1	captured/keyed
4/30/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
4/30/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
4/30/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
4/30/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	2	2		captured/keyed
4/30/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	3	3		captured/keyed
4/30/1997	Sceloporus occidentalis	Northwestern Fence Lizard	1			captured/keyed
4/30/1997	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
5/1/1997	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
5/2/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	3			captured/keyed
5/2/1997	Sceloporus occidentalis	Northwestern Fence Lizard	1			captured/keyed
5/3/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1			captured/keyed
5/4/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
5/4/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
5/4/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	2	2		captured/keyed
5/4/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	2	2		captured/keyed
5/4/1997	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
5/6/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
5/6/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	2	2		captured/keyed
5/7/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
5/7/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
5/7/1997	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
5/7/1997	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
5/8/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
5/8/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
5/8/1997	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
5/8/1997	Sceloporus occidentalis	Northwestern Fence Lizard	1	1		captured/keyed
5/8/1997	Sceloporus occidentalis	Northwestern Fence Lizard	2	1		captured/keyed
5/8/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed
5/9/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	4	4		captured/keyed
5/9/1997	Gerrhonotus multicarinatus	Southern Alligator Lizard	1	1		captured/keyed

TABLE 20
Water Quality And Fish Sampling—Standish Dam

Ponded Water Quality	Dates	Stations	Parameters
	1990 Jun–Oct	(Q2A), Q3–Q8	Temperature, DO, depth, (salinity, clarity)
	1991 Jun–Sep	Q3–Q8	Temperature, DO, depth
	1992 May–Sep	Q3–Q9	Temperature, DO, depth, clarity
	1993 May–Oct	Q3–Q9	Temperature, DO, depth, clarity
	1994 Jun–Oct	Q2–Q9	Temperature, DO, depth, clarity
	1995 Jun–Sep	Q2–Q9	Temperature, DO, (solubility saturation calculated), depth, conductance (converted to salinity), depth, clarity
	1996 Jun	Q2–Q9	Temperature, salinity, depth
	1997 May–Oct	Q3, Q5, Q7, Q8	Continuous temperature with loggers
Tidal Conditions	1990 Mar, May, Nov, Dec (dam out)	Q1, Q2, Q3, Q6, Q8	Salinity (conductivity), temperature, depth
	1990 Jun–Sep (dam in)	Q1, Q2	Salinity, temperature
	1991 Nov (dam out)	Q2, Q6, Q8	Salinity, conductivity, temperature, depth
	1991 Jul, Sep (dam in)	Q1, Q2	Salinity, conductivity, temperature, depth
	1992 Jul (dam in)	Q1, Q2	Salinity, depth
	1996 Oct–Mar (high tide)	Q3, Q6, Q8, Q9, Q10, Q11 (and sometimes at location downstream of Dixon Landing Road)	Temperature, specific conductance, salinity, streamflow at Hwy 237
	1998 Oct	T3, T6, T8, T9, T11	Temperature, salinity, depth
Fish Sampling	1992 Aug	Q3, Q6	Beach seines, gill nets, no salmonids
	1993 Aug	Q3, Q6	Beach seines, gill nets, no salmonids
	1994 Aug	Q3, Q6, Q9	Beach seines, gill nets, no salmonids

Ponded Water Quality	**Dates**	**Stations**	**Parameters**
	1995 Oct	Q3, Q5, Q6, Q9	Beach seines, gill nets, electrofishing, no salmonids
	1996 May, Jun	200 feet downstream of Hwy 237	Fyke net, no salmonids
	1996 Jul, Aug	Q2, Q3, Q4, Q5, Q6	Beach seines, gill nets, no salmonids
	1997 Apr, May, Jun	200 meters downstream of Hwy 237; 150 meters downstream of Montague Expressway	Fyke net—outgoing migration, two steelhead/rainbow trout young-of-year*
	1998 May, Jun		Fyke net—outgoing migration, 15 steelhead smolts

*Steelhead/rainbow trout captured in 1997 may have been a result of experiment of effectiveness of the trap.

Table 21. Absolute Percent Vegetation Cover
Upstream of Standish Dam

	Date Planted	Distance u/s of Standish Dam (feet)	Monitoring Years	Total Overstory	Total Tree Overstory	*Populus* Overstory	*Salix* Overstory	Snag
Site 1-1 Island	1991	300 - 1300	1994	8%	10%	2%	7%	0%
			1996	43%	26%	8%	15%	4%
			1997	32%	18%	6%	9%	3%
			1998	34%	24%	9%	13%	2%
Site 4-2 Fish Shade	1992	3600 - 4400	1994	50%	54%	25%	19%	1%
			1996	77%	82%	30%	42%	3%
			1998	82%	97%	31%	54%	1%
Site 4-3 Setback	1993	4400 - 5500	1994	51%	50%	46%	2%	0%
			1996	71%	72%	64%	5%	0%
			1998	66%	64%	54%	3%	1%
Site 5-4 Pilot Reveg Site	1987	6000 - 7500	1994	46%	46%	13%	3%	3%
			1996	59%	60%	10%	3%	2%
			1998	58%	65%	14%	11%	3%

Standish Dam was installed in the summer of 1994, 1996, 1997 and preceding summers, but was not installed in 1998 and 1999.

Table 22. Tree Overstory - Coyote Creek 1994, 1996, 1998
Upstream of Standish Dam

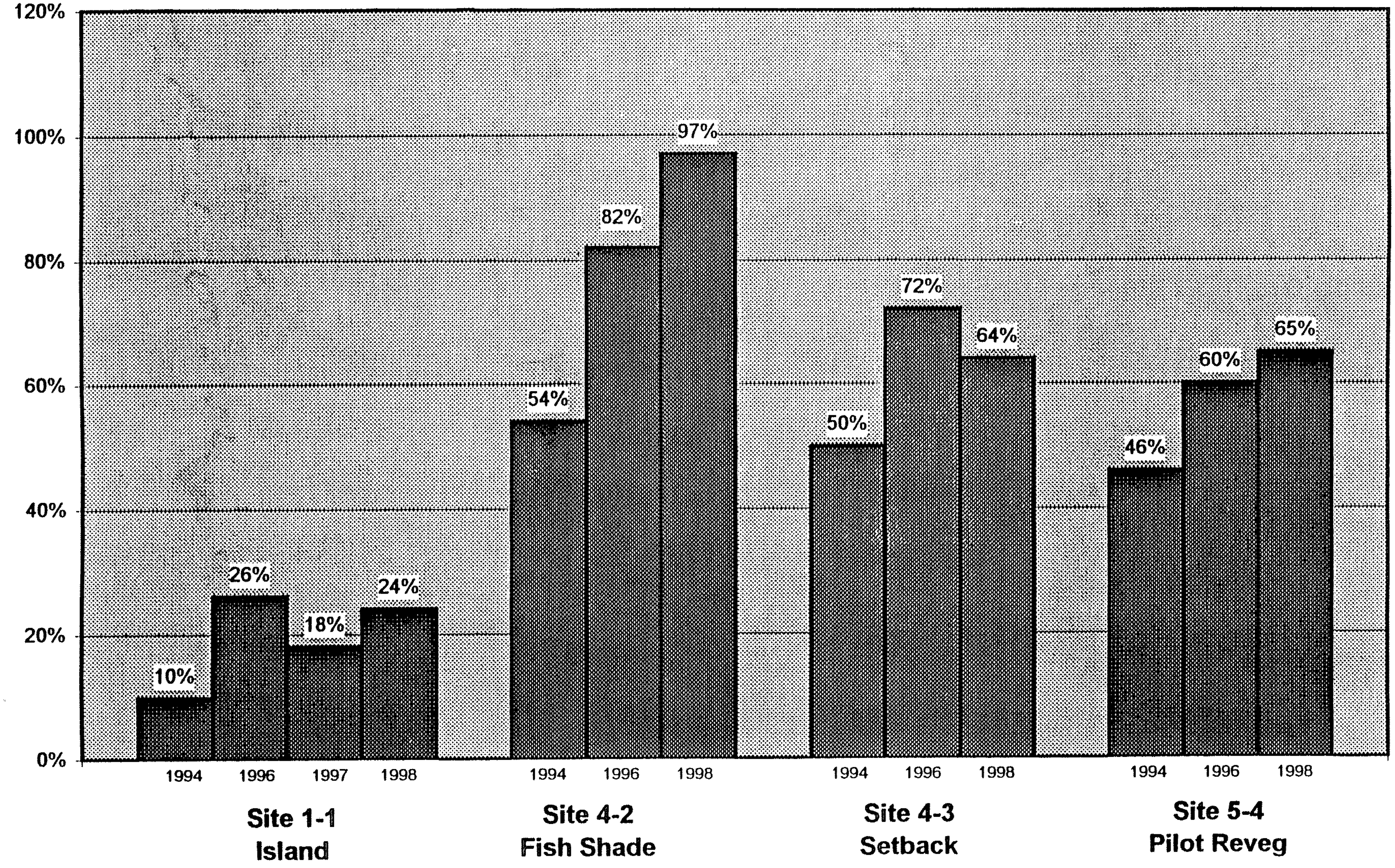
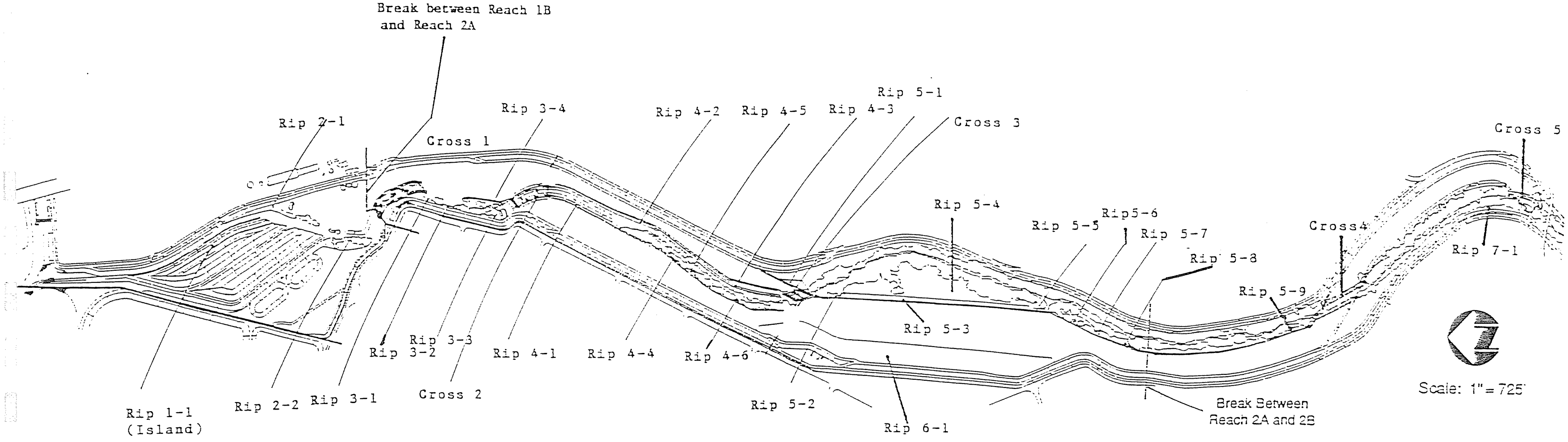


Figure 3. Reaches 1B and 2, Coyote Creek Mitigation Areas



Prepared by:

Jones & Stokes Associates, Inc.

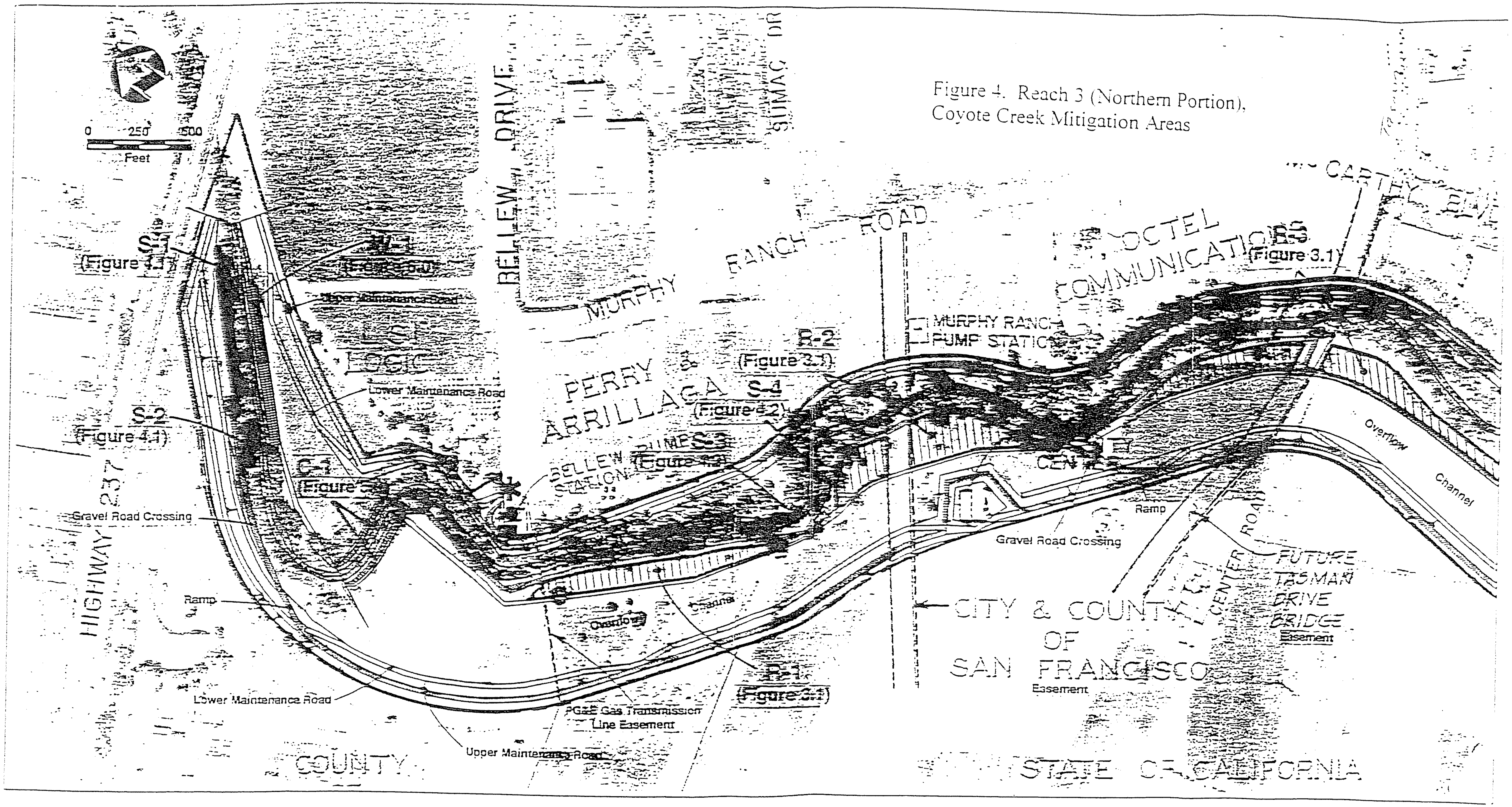


Figure 4. Reach 3 (Northern Portion), Coyote Creek Mitigation Areas

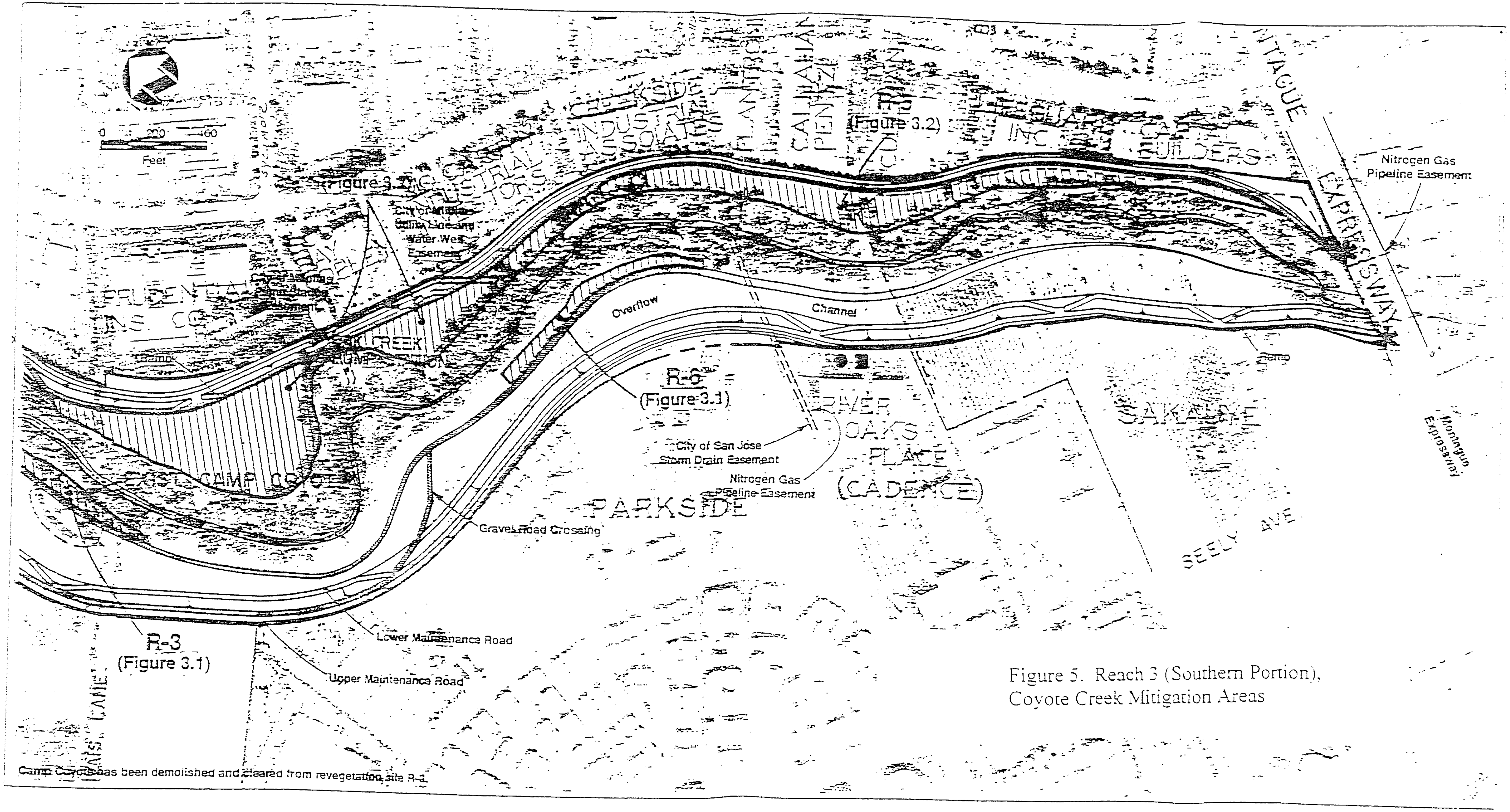


Figure 5. Reach 3 (Southern Portion), Coyote Creek Mitigation Areas

Camp Coyote has been demolished and cleared from revegetation site R-3.

Figure 6. Wildlife Monitoring Locations, Reach 2, Lower Coyote Creek

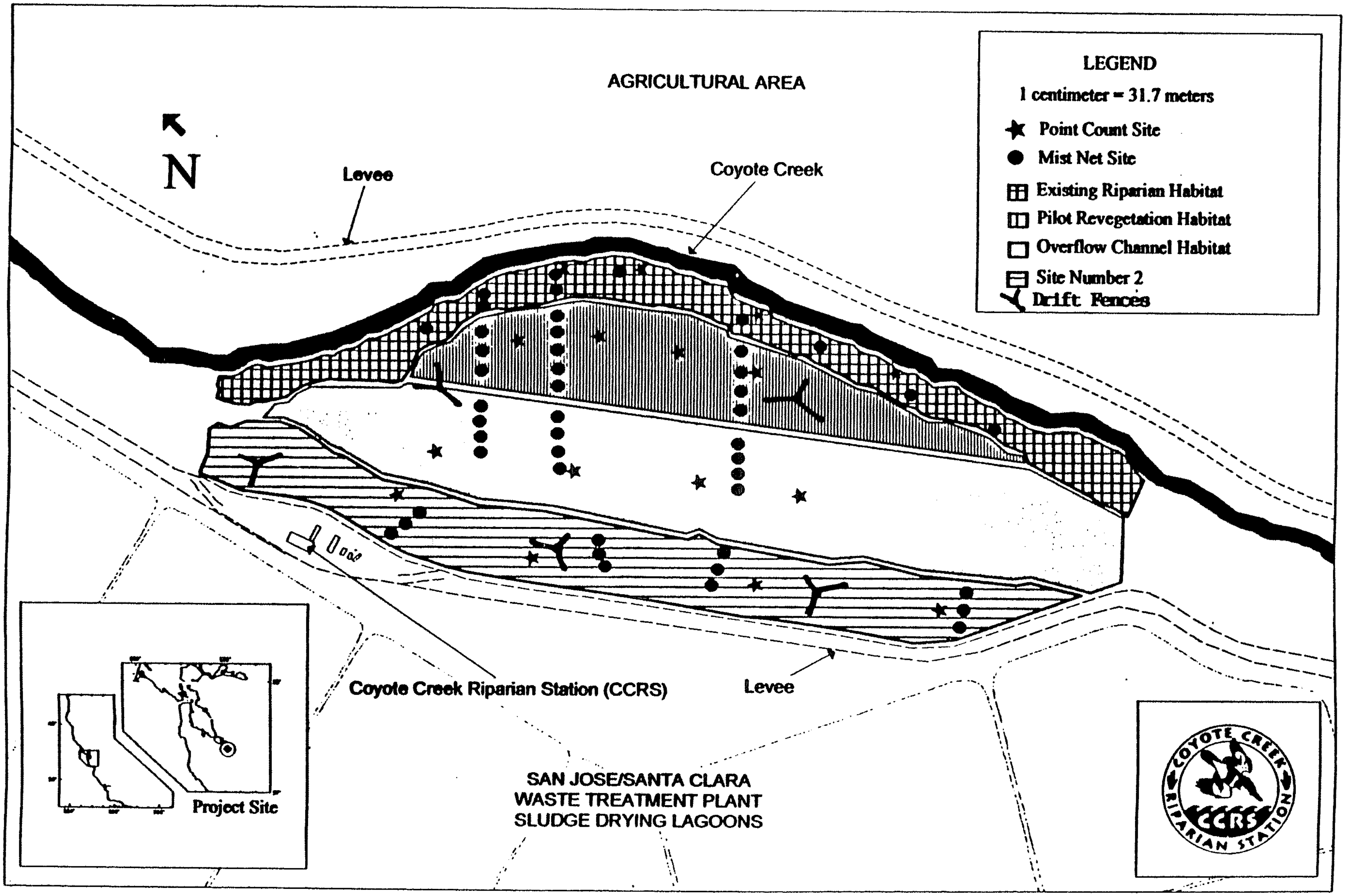


Figure 7. Water Quality Monitoring Locations, Lower Coyote Creek